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SOIL EROSION.

Rather more than a year ago, attention was directed in this Journal to the question of soil erosion, and the danger of serious deterioration of estate property through that agency. It was pointed out that the most valuable asset that a country possesses is its soil, and that it is essential that all agricultural operations should be directed towards the maintenance of its fertility. The removal of the surface soil, either by "dry wash," or by the action of the rains, deprives the land of its richest and most fertile part, and, if not arrested, will ultimately render its cultivation unremunerative.

It should be unnecessary to have to emphasise this fact in Ceylon. Land which was under coffee, and was abandoned after the failure of that product, still remains derelict in many cases, while in some parts the foot hills, cleared of jungle long ago, have become mere heaps of cabook.

In Ceylon, and in tropical planting countries generally, though dry wash occurs in a few places to a greater extent than has hitherto been recognised, the loss of surface soil is due chiefly to the action of the rains. This is true of all countries which are not so dry as to be almost desert, whether temperate or tropical. In the tropics, however, because of the heavier rainfall, the effect is naturally much more pronounced, though it is still sufficiently marked in the temperate zones to induce investigations into methods of prevention.

Much has already been done in Ceylon in a general way which, directly or indirectly, tends to diminish the serious loss of soil which was taking place. The construction of terraces

on rubber estates, the alignment of drains with due regard to the contour of the land, and the provision of silt pits are all steps in the right direction. Further, the practice of growing green manure crops aids by diminishing the force of the rain on the surface of the soil, though, as has previously been pointed out, we have asked too much of our green manure plants in expecting that they would serve effectively the dual purpose of green manures and preventers of soil erosion.

There has been a tendency hitherto to confuse this question of soil erosion with others, such as the conservation of the water-supply of the country, which, though, like it, dependent upon the rainfall, will be seen on further consideration to be quite distinct, and, as far as planting interests are concerned, often diametrically opposed. It is not, in the average planting district of Ceylon, to the planter's interest to conserve water. His interest is rather that of the cultivator in most other countries, namely, to get it away as soon as possible, and it is in that process that the danger arises. It cannot be too strongly insisted upon, that, as far as regards the maintenance of the soil of estates, the dominant factor in the promotion of soil erosion is the run-off from cultivated land, that is the point at which the soil erosion question has to be attacked, and the responsibility for that rests with the estates themselves.

The determination of the amount of erosion which takes place from land cultivated in different ways is, at present, more or less of academic interest. We know that erosion is taking place, and the immediate problem is how best to stop it, or rather, to reduce it as much as possible. As will be seen from an abstract of American work on this problem, included in the last number of this Journal, the determination of the relative amounts of soil lost under different conditions would occupy several years, and, to be of value, would involve the construction of masonry work to such an extent as could only be contemplated on a tea experiment station. We write "tea" advisedly, for, as we see it at the moment, it is on up-country tea estates that this problem will prove the more difficult.

There are two lines of action which can be taken up immediately. One is the establishment of contour belts of cover plants. These should be continuous bands of low-growing, preferably creeping, plants at intervals across the slope of the land. They require to be continuous, because gaps serve as passages which gradually deepen and cut out channels down the hill-side. For the latter reason, erect stout-stemmed plants are unsuitable, in addition to being a hindrance to working in tea if planted densely. By growing such plants in bands, cultivation can be carried on over the intervening areas without difficulty. Up to an elevation of 4000 feet, the smaller Desmodiums should prove suitable, while at the highest elevations, Dutch clover (*Trifolium repens*), which grows wild in Nuwara Eliya, should be tried.

The other step which can be taken at once is the protection of the sides of the main drains which run down the slope. In many instances, these are now deep ravines, owing to the constant erosion of their banks. This formation of ravines can be prevented by growing grass along the sides in the case of permanent streams, or over the whole drain, if it is usually dry. Here again, a creeping grass, such as *Paspalum conjugatum*, is required, rather than one which grows in tussocks.

For the permanence of the prosperity of this country, it is of the greatest importance that those responsible for the control of estates should realise the urgency of this problem, and should undertake trials to ascertain what plants can be grown on their properties in the manner indicated. Prevention of this form of soil erosion will in any case rest with the estate. The matter, however, is one of national, as well as of private, interest, and no country can continue to regard with equanimity the loss of its chief asset, especially when that loss is to a great extent preventable.

TEA.

MANURING EXPERIMENTS ON TEA.

T. PETCH.

A series of trials with nitrogenous manures on tea was begun on the Experiment Station of the Indian Tea Association in 1920, and two accounts of these have been published, the first in the *Quarterly Journal*, Part I (1921). pp. 10-20, and the second in the same Journal, part II (1924), pp. 91-98.

The tea under experiment was planted as one-year-old stumps in 1916, collar pruned in 1918, and plucked from 1919. The plucking during 1919 was intended to show the relative value of the plots before manuring, but the yields were so small that "the error in the plucking and weighing of the leaf obtained at each plucking exceeded the difference between the plots, and in that year therefore no figures were obtained which could be considered of any value for measuring the initial fertility of the plots." As the tea was not pruned in 1919, the yields in 1920 were larger, and the first three pluckings in 1920 (April-May) were taken as showing the relative value of the plots. This point will be referred to later.

Each plot consisted of 54 bushes. Eighteen plots were taken for the experiment, three under each treatment and three as controls. The relative situations of the plots and the method of separation are not given. There were no vacancies in the plots, but there were several supplies and weak bushes which were not plucked in 1920. The numbers of these bushes and the dates when they were taken into plucking are not stated.

In 1919 all the plots received slaked lime at the rate of 800 lb. per acre. The manures under trial were applied in May 1920, and thence annually except in 1921. Three plots received nitrate of soda at the rate of 212 lb. per acre; three, sulphate of ammonia, 150 lb. per acre ; three, mustard cake, 704 lb. per acre; three, nitrox, 320 lb. per acre; and three, green jungle, 3 tons per acre. All the plots, including the three controls, also received bone meal, in 1920, sufficient to make up a total of 35·6 lb. phosphoric acid per acre, but from 1922, the phosphoric acid in the mustard cake and nitrox was disregarded and bone meal added to all the plots at the rate of 162 lb. per acre. Nitrox is a mixture of sinews, hoofs and horns, as finely divided as is possible with such material.

From 1920, the bushes have been top-pruned to three-fingers of new wood each year. Cultivation consisted of a deep hoe at "a 15 null task" in November or December, followed by six light hoes during the year, of which at least three are put in before the break of the monsoon. In 1920, the bushes were plucked nine times, from April to November, and presumably similarly in subsequent years.

The published table of results of the experiment is as follows, the yields being given as "Corrected yields in maunds pucca tea per acre."

	1920	1921	1922	1923	Total	Percentage increase.
Control	9·58	7·7	7·97	8·67	33·92	—
Nitrate of Soda	10·55	8·1	9·40	12·00	40·05	18·07
Green manure	10·01	8·4	8·45	10·22	37·08	9·31
Oilcake	9·86	7·6	9·95	10·50	36·91	8·81
Sulphate of Ammonia	10·24	7·5	8·09	10·04	35·87	5·75
Sinews	9·35	7·5	7·76	9·60	33·81	0·32

Unfortunately, these are all the figures given relating to the yields, except for some in the earlier paper relating to 1920. The actual yields are not stated. All these are calculated yields, and the basis of calculation or correction is not disclosed. In the first year's figures in the earlier paper, the yields were corrected for unplucked bushes and then raised to "yield per acre;" but how long this practice was continued is not recorded. It may be noted that the yields given above for the year 1920 cannot be harmonised with those given for the same year in the earlier paper.

The yields from the separate plots would no doubt be obtained as green leaf. It would have been of interest to know what factor was employed in converting those weights into the equivalent quantities of made tea. The "corrected" yield of green leaf from the control plots for the whole of 1920 was 3,063, and from the beginning of the experiment to the end of 1920, 2,465 lb. per acre. The equivalent yield of made tea (at 80 lb. to the maund) is given as 766 lb., which on the larger figure indicates a conversion factor of one-quarter. But on this basis, the yield of the nitrate of soda plots in 1920 should be 10·2 maunds, and that of the green manure plots 10·6 maunds.

As the yields of the separate plots are not given, it is not possible to ascertain what variation occurred between the three plots under each treatment. Each group of three plots is treated as one, and as far as the records show there was no advantage in calling them three.

It is now generally recognised that the plots of an agricultural experiment are not as a rule of equal value, and methods have been elaborated by which this variation can be calculated. Without such calculations, it is not possible to estimate what value can be assigned to the results obtained. As already stated, an attempt was made in the present case to ascertain the relative values of the plots by plucking each separately during the year previous to beginning the manuring, but owing to the small yield that was unsuccessful, and the only available data for this purpose are the yields of three pluckings at the beginning of the season of 1920. These, however,

are obviously insufficient. As they stand, the initial yields of the separate plots vary from 8 lb. 8 oz. to 16 lb. 3 oz., a variation of nearly 100 per cent. These are the actual yields; but the variation is due, to an unrecorded extent, to the presence of bushes not yet fit for plucking. It is shown that the averages of each set of three do not differ by more than ten per cent. (there is an error in the average of the nitrate of soda plots), but unless the unplucked bushes were evenly distributed that scarcely meets the case. An attempt has been made to overcome the difficulty by adding a proportionate amount in each case for the unplucked bushes, but this again is inadmissible.

Taking the figures of the preliminary pluckings as they stand, they indicate that the plots subsequently manured with green manures were, on the average, initially the best plots; and those subsequently manured with ammonium sulphate were, on the average, initially the worst, the difference between the best and the worst set of three being about 10 per cent. But how far the differences depended on the number of bushes in plucking is not recorded. In any case, however, it would be expected that these bushes would be inferior to the others for some years after they were taken into plucking, so that the plots which contained the greater number would remain inferior.

The plots were left unmanured in 1921, in order to ascertain the residual effect of the manuring of the previous year. Since little residual effect, in the ordinary sense, could be expected from the soluble manures, it might be supposed that the yields of 1921 would serve to show the relative value of the control and the soluble manure plots when unmanured. In dealing with a crop like tea, however, there may be a "residual effect," other than the effect of unexpended manures, to which the term is usually applied. The previous manuring may have induced a greater production of branches, and consequently a greater plucking area, and this effect will be permanent, under the conditions of pruning of this experiment. Hence the yields of 1921 cannot be taken as indicating the original relative values of the plots. They can, however, as far as regards the three series of plots mentioned, be taken to indicate the relative values of the plots at the beginning of the second period of manuring, 1922-23. On that basis the initial value of the nitrate of soda plots for the second period is 5 per cent. greater than that of the control plots, and 8 per cent. greater than that of the sulphate of ammonia plots.

The experiment was evidently planned in such a way that the probable errors of the plots could be estimated, but unfortunately its subsequent treatment has rendered that impossible. It would have been preferable to have delayed the beginning of manuring for another two years, by which time the supplies might have been in bearing, and the bushes might, perhaps, have been pruned to a standard shape. As it stands, one cannot resist the conclusion that the experiment was begun too soon. That is always a temptation in the case of a crop which takes several years to come into bearing, and it may sometimes be forced on the experimenter by a demand for results. It cannot be too strongly insisted on that to begin an experiment of this nature before the plots are sufficiently mature, or before the necessary preliminary data have been secured, may render the whole

experiment valueless. Two such instances come to mind. When the Chilaw Coconut Trial Ground was instituted, orders were given that the yields of the separate plots should be recorded before any manuring was begun. Shortly afterwards, however, the management passed into other hands, and in the desire to "get something done" the plots were manured, with the consequence that the results are inconclusive. Again, in response to a demand that something should be done on the Experiment Station, Peradeniya, young rubber was tapped before the plots were sufficiently mature to afford a reasonable number of trees; and the endeavours to correct that deficiency during the course of the experiments rendered the tapping of 1910-11 valueless, besides spoiling the trees for any experiment during the next four years.

As the results stand, the nitrate of soda plots show an increase of 9 per cent. over the green manure plots and 12 per cent. over the sulphate of ammonia plots, but the magnitude of the probable error of the experiment is not known. These results have been obtained with a system in which the bushes are plucked for a season of eight months in the year, and are pruned and manured annually.

An explanation is necessary as regards the green manures. In 1920, the green manure plots were sown with Sunn Hemp, but this failed owing to the attack of a root disease, and green jungle—thatch, Melastoma, and Boga medeloa—was cut from neighbouring waste land and lightly hoed in July at the rate of three tons per acre. The latter course has been followed in subsequent years, but the plants used are not specified. It is stated that by this method the tea does not suffer while the green crop is growing. Such an effect, however, has not yet been demonstrated. Indeed, it is claimed by some investigators that a leguminous intercrop exerts a favourable effect on the main crop while growing.

It was noted that the quick-acting manures gave a relatively heavy yield at the beginning of the season and a comparatively early close. The slower-acting organic manures were steadier yielders, and tended to give more leaf in the latter half of the season, that being particularly the case with the green manure.

In 1920, it was observed that the plots manured with nitrate of soda maintained their yield longer than those manured with sulphate of ammonia. As this was contrary to expectation, the sample of nitrate of soda was analysed, and was found to contain 5 per cent. of potash. The observed effect was attributed to that in part.

It is stated that "following the hoeing in of the 3 tons per acre of green stuff on July 17th (1920), the rise in the yield was almost immediate. The effect of the green stuff was in fact more rapid even than that of nitrate of soda. The green stuff was of course applied at a season when the effect would be expected to be more rapid. Temperature and soil moisture were both very favourable." It would scarcely seem probable that this effect was due to the green manure as such, and further investigation of this point is desirable.

SCHOOL OF TEA CULTIVATION IN BRAZIL.

For the encouragement of the development of the cultivation of the tea plant in the State, the Government of Minas Geraes has established in Ouro Preto in the grounds of the former botanical gardens an "Aprendizado Agricola," especially devoted to the cultivation of the tea plant and the working of the crops. Care has been taken to restore the existing plants; and, for establishing new plantations, one hundred thousand Assam and China plants have been provided.

The scientific preparation of the first crops with the use of simple machinery gave a perfect product as regards taste and aroma.—International Review of the Science and Practice of Agriculture, Vol. II, No. 3.

TEA PLANTING IN KENYA.

In a recent issue of the *Farmers' Journal* a digest of London Tea Finance was published, giving the dividend declarations of all the principal Tea Companies of India and Ceylon, from which it can be seen that tea is enjoying an exceptionally prosperous time. Companies which had not paid a dividend for years were able to declare 15%; companies which had had always paid a dividend, earned last year as much as 70%; on every hand the business of tea companies experienced a boom year. The causes underlying this sudden prosperity are difficult to define. The shortage of top quality coffee from Brazil, where only poor grades are available under the Government Valorization scheme, may have resulted in an increase in tea consumption in America. If this is so, that advertising campaign just started there by Sir Chas. Higham and Mr. Duncan of the Indian Tea Association will naturally help, especially when it is learned that 10, 000, 000 additional homes in America will be reached by specially prepared tea advertisements for which an appropriation of one million dollars has been made "to make Americans drink more tea, less coffee."

Under such prospects has the cultivation of tea come to Kenya. Well-defined areas in Kenya are eminently suited to tea production, as has been shown by reports published from time to time in this Journal of experiments made here, as well as reports from experts on samples of tea manufactured in this country. The prospects of tea cultivation in Kenya are sufficiently satisfactory to induce Messrs. Brooke Bond & Co., Ltd., the well-known tea firm, to launch a plan for the cultivation of tea at Limuru.

The draft scheme of this plan is published below for the information of readers. Apart from amateur efforts on a small scale the only large scale operations being conducted, besides Brooke Bond's, is at Kericho where a large company are at work, and the Kakonde Estate of Mr. Talbot in Uganda. Large scale operations require large capital because of the machinery required for manufacturing the tea, but plantations on a scale of 20 to 40 acres are quite possible to operate at a profit. It is some two years ago now since articles on tea production were first started in this Journal for the information of those wishing to start planting, but the time has arrived

when fuller information will be required on the subject. The experimental stage has been passed and there is no doubt from the interest shown in tea production that in time to come tea will be a serious competitor of coffee. There is room for both in the country, and finance will be strengthened, as it is rarely that the world has experienced a slump in both commodities at the same time.

The following is a copy of the Draft Scheme proposed by Brooke Bond & Co., Ltd., for the introduction of Tea growing into Kenya Colony.

The Company has in mind the fact that certain parts of Kenya Colony, East Africa, are adaptable to the growth and production of tea, and to that intent the Company has purchased a certain holding of land, at Limuru, part of which it is proposed should be used for the planting and cultivation of tea plants, and another part shall be used for the erection and maintenance of a factory for the manufacture of tea from the green leaf produced on such estates; but inasmuch as it is desirable to interest surrounding farmers in tea production, it is proposed that the Company should make certain arrangements with farmers, in the locality, whereunder a suitable part of each farm should be prepared and used for the growth of tea plants and the production of green leaf eventually to be made into tea, and that the Company should provide seeds to a certain value to plant a maximum of about 250 acres on each farm, the work to be carried out under the instruction and directions of the Company's planting expert.

The scheme proposed has many advantages ; it offers the farmer expert advice in the original selection and preparation of his land for tea planting, it provides him with suitable seed, it affords him facilities for obtaining expert assistance in the cultivation of the plants till the bearing period arrives, and thereafter general guidance will be forthcoming in the cultivation of the crop.

Later it effects all the selling arrangements necessary, basing its return on public sale price, less deductions for expenses of packing, transport, freight, insurance, brokerage, and other necessary charges (which are more or less constant).

The terms and conditions upon which this scheme is to operate are broadly as follows :—

1. The Company will make such inspection of farms, adjoining their own property, as they may consider necessary with a view to ascertaining what, if any, parts of such farms are suitable for the growth of tea plants.

2. As a result of such investigation the company may enter into negotiation with the owner of the farm who may either be a long leaseholder, but is more probably a free-holder, on the basis that the Company will supply seeds sufficient to plant not more than 250 acres in tea at cost to the farmer of £750 or proportionately less on smaller acreage.

3. The Company will, then, by its planting expert, give full directions as to the cultivation and planting and subsequent cultivation of the tea bushes during their period of growth, the work and labour actually being done by the farmer and his employees at the farmer's expense, but in all cases under the direction of the Company's planting expert. The farmer will pay to the Company at the rate of 5 per acre per annum for the period of 4 years, for the services of the Company's planting expert, during the four years

in which the seeds should produce tea bushes capable of bearing. The approximate cost of the seeds and the charge for supervision over the first four years, which is expected not to exceed £1,000 on an acreage of 250 acres, shall be repaid by the farmer to the Company out of the proceeds of the tea produced during a period of ten years, commencing from the fourth year after the seed has been supplied. The farmer may repay such moneys at the rate of £8-6-8 per month in the case of a full 250 acreage or proportionately less for a smaller acreage, and the Company shall be at liberty to retain out of the proceeds provided by the sale of teas such monthly sum, if they in their discretion shall think fit so to do.

4. For a period of 15 years from the signing of the contemplated agreement the farmer will bind himself to deliver all green leaf and tea seed for sale produced by him to the Company, to be manufactured as hereinafter mentioned notwithstanding the fact that the farmer may before the expiration of such 15 years have repaid his whole debt to the Company.

5. The Company shall proceed to manufacture, in their central factory on their own land, the tea so delivered to them by the farmer, on the basis that a charge of 3*d*. per lb. of manufactured tea shall be made to the farmer and debited against his account in respect of such manufacture, but such charge of 3*d*. per lb. shall not include packing or any charges subsequent to the packing of the tea. In the event of it being found that, after the experimental stage has been passed, the above cost of 3*d*. per lb. is too heavy, the cost to the farmer of the manufacture of tea shall be a sum equal to the actual net cost to the Company of such manufacture plus ½*d*. per lb. but not to exceed 3*d*. per lb., such nett cost to be ascertained by the accountants to the Company and to include all running cost, wages, overhead charges, rent, interest on capital, insurance, management and other charges of the like nature, usually incurred in the manufacture of tea from the green leaf, and shall be final and binding on the parties save for evident error discovered within two months of the date of any account. The packing charges shall be per lb. of manufactured tea.

6. It is estimated that the percentage of manufactured tea on the weight of average quality green leaf is about 20%, but except as later mentioned the actual outturn of manufactured tea is the basis of all calculations. Each farmer shall be credited with such proportion of the manufactured tea *in each week* which his inturn of green leaf during such week bears to the total inturn of green leaf during such week. It is further part of the above arrangement that the Company shall be at liberty to manufacture any green leaf which, in the opinion of the Company, may be badly plucked or not in good condition, by itself, and not in conjunction with other green leaf, in which event the charge for the manufacture of such tea shall be a fixed charge of 4*d*. per lb. notwithstanding the provisions of paragraph 5, and the amount of manufactured tea shall be the weight actually produced and the tea so produced shall be sold as a separate lot unassorted. In the case of any dispute the same shall be submitted to the arbitration of three other farmers, members of the scheme, one to be appointed by the Company and the other two by the whole of the other farmers by secret ballot.

7. During the said 15 years, all tea thus manufactured and ready for sale, shall be sold under Agency of the Factory Management, through the ordinary channels for sale of tea in public sale in London, provided always that any farmer entering into the scheme may sell all, or any part of the tea so manufactured on his behalf to the Factory Management at such price as may be mutually agreed on, but in the absence of agreement such tea to be sold as above provided.

8. Each farmer will be entitled to be paid for made tea at the average price for which the invoice is sold in London public sale less the cost of manufacture, packing, transport, insurance, brokerage and cost of sale and all other charges of whatsoever nature incurred in selling of the tea.

9. The Company will undertake the payment for account of the farmer concerned of all charges or expenses in respect of tea after the tea has left the Factory including brokerage on sale.

10. Any farmer entering into the scheme shall, in the event of his desiring to sell his farm, first offer the farm to the Company; and the Company shall at all times have the option of first refusal of any such farm at a price equal to the highest actual bid received by such farmers.

11. So far as is allowed by law each farmer shall charge or mortgage his farm with the repayment of such amount as may be repayable by him to the Company or provide some other protection in respect of the money referred to in Clauses 2 and 3, it being especially agreed that the agreements constituted by Articles 4 and 10 shall be made the subject of a separate agreement between each such farmer and the Company.

12. The farmer shall further enter into such binding agreements as shall be necessary to prevent the farmer from selling or disposing in any way other than by planting and cultivating the same within the true intent of the arrangements constituted as above, any tea seeds or plants raised from seed supplied by the Company, and that any plantations raised from the Company's seed shall be cultivated and maintained in good heart and condition and good order until all sums due from the farmer to the Company shall have been paid.

13. In cases in which there shall already be any mortgage or charge over the farm of any farmer who may join the scheme, the farmer shall so arrange that the person, firm, or corporation holding any such mortgage or charge, or being entitled thereto, shall join in, confirm, and concur in all the arrangements contemplated by the above scheme, and such person, firm or corporation shall bind itself so far as may be necessary to that intent.

14. All matters of dispute not made the subject in this scheme of special arbitration shall be referred to arbitration in the usual way, the arbirators to be appointed by a secret ballot of the whole of the farmers joining the scheme and the Company.

FARMERS' TEA PLANTING SCHEME.

At a meeting of Limuru Residents held to consider the terms of the above proposal the draft scheme was generally approved after discussion.

The following amendments however were recommended.

Paragraph No. 4 (a) That to clause "will bind himself to deliver all green leaf" shall have added to it the words "and tea seed for sale." (b) The farmer will also bind himself during the afore-mentioned 15 years not to sell or give away any tea seed except through the Company.

Paragraph No. 10. It is proposed to do away with this paragraph as it stands as "the highest actual bid," except at auction sales, is considered impossible to determine. Further the paragraph creates a false impression in that it rather pre-supposes the eagerness of Messrs. Brooke Bond & Co., Ltd. to acquire farms in the vicinity which is quite incorrect. On the other hand the deletion of Paragraph 10 in its old form is not intended to exclude Brooke Bond & Co., Ltd., as possible buyers.

In place of the old paragraph 10 please read—(a) "Any farmer entering into the scheme shall agree not to sell his Farm to any third person, or persons who refuse to continue the original agreement with Messrs. Brooke Bond & Co., Ltd. in respect to the tea on the said property; (b) That any person, firm or corporation who may have lent money upon the property shall be called upon to agree and conform to the agreement between any land owner and Messrs. Brooke Bond & Co., Ltd. as detailed in paragraph 13. (c) That any person requiring a loan after entering upon the agreement shall state the case and give Messrs. Brooke Bond & Co., Ltd. the first refusal of making the necessary advance, on proposed security.

Paragraph 10 (c) shall be included or not in each case when drawing up the agreement, and shall not be made binding on all.

Paragraph 11. To prevent taking out a special mortgage on small amounts for tea seed and supervision expenses, where small acreages are contemplated, the words "or provide some protection" be inserted after the phrase "be payable by him to the Company."—Farmers' Journal, Vol. 6, No. 41.

GREEN MANURES IN JAPAN.

Japanese tea farmers are prejudiced against green crops as manures on the grounds that quality will be lost if they are employed. Work at Kanaya has, however, shown that green manuring makes for quality. Vetch, Soya bean and Seradella (*Ornithopus sativus*, Brot.) have been used. Seradella, sown in September and cut in June, grows to a height of two feet and gives a crop of about six tons per acre. Soya bean, sown in April and cut in August, grows to a height of four to five feet and gives a crop of over two tons per acre. Vetch, resembling Seradella, grows to a height of five feet but climbs over the tea. The crop is about six tons per acre.

Red Clover is sometimes cultivated as a green crop and *Astragalus sinicus* is grown in the rice-fields in the winter months and transported to the tea gardens.—C. R. Harler, B.Sc., F.I.C., in Quarterly Journal, Scientific Department, Indian Tea Association, Part 1, 1924.

COCONUTS.

MANUFACTURE OF COPRA IN THE PHILIPPINES.

P. J. WESTER.

The following extract is taken from the article on Manufacture of Copra in the Philippines by P. J. Wester in the *Philippine Agricultural Review*, Vol. XVII, No. 2.

Coconut growing is one of the most important industries in the Philippines. In 1922, 422,284 hectares were planted to coconuts with a total production of nearly one and a half billion nuts, of which the greater part were made into 351,151 tons of copra, valued at 44,000,000 pesos in round figures. Coconut products ranked third in importance among our industries, being exceeded only by rice and sugar. Among the exports they held the first place with copra, copra meal, and coconut oil exports totalling 62,100,000 pesos. The number of trees planted has about doubled in the last ten years.

While the Philippines is one of the principal producers of copra in the world, it is a distressing fact that the product from here fetches the lowest price. It is estimated that as compared with the price of Ceylon copra, the Philippine planters in 1922 sustained an economic loss of about nine million pesos. This amount would have more than paid for all the meat and dairy products imported in the same year. It is almost equal to the total exports of embroidery, hats, and lumber. This enormous loss is due to the poor grade of copra produced, largely because of insufficient and faulty drying and handling.

Somewhat more than one-half of the copra was *tapahan* dried in 1922, and a correspondingly smaller part was sun-dried. Less than one-half of one per cent. was dried on modern driers.

Efforts have been made to induce the planters to improve their methods of drying, and good driers have been installed on a few plantations the owners of which were not satisfied with the low prices offered for copra made by the native methods. But little or no improvements have been effected among the rank and file. The individual holdings are small as a rule, and exporters and millers are not willing to pay an advanced price for superior copra in small lots. Under such circumstances, and where a majority of the planters are indifferent to the production of better copra, there is little or no inducement for those who realize the losses incurred because of the poor grade of copra produced to improve their own output. Unless concerted action is taken by the small planters of a district to induce improved methods of drying copra by a majority of the producers on a sufficiently large scale to demand recognition by exporters and local millers of copra we need expect little or no improvement either in the copra grades or the prices paid for the product until the production on the large plantations shall have reached such a figure that their copra is shipped out in, say,

one thousand ton lots. Then the ambitious small planter will not be so dependent upon the action of his more indifferent neighbours as he is now.

Copra is the dried meat of the coconut, and at present constitutes the principal and the most important article derived from the coconut palm.

According to Preuss the fresh coconut meat analyses as follows :

	Per cent.
Water	49·83
Oil	32·97
Albumen	2·89
Nitrogen free extract	4·62
Crude fibre	8·66
Ash	1·03

Clean, sun-dried copra analyses ,55 per cent. oil ; artificially dried copra, 60 to 65 per cent.

The meat is dried in the sun or in artificial driers, among which may be classed the so-called "tapahan" driers, in which most of the Philippine copra is prepared.

In order to successfully resist deterioration from moulds and bacteria and so produce a first-grade oil and secure the highest price obtainable in the market, copra should be made only of fully matured or "cured" nuts ; it should be thoroughly dried so as to make a clean product, containing not more than 6 per cent. of water. Ordinary sun-dried copra contains about 9 per cent. and "tapahan" or smoke-dried copra frequently exceeding 20 per cent. of moisture, a condition that, particularly in long storage in a moist, damp atmosphere, is all too favourable for the growth of moulds, the foremost enemy of improperly prepared and improperly cared for copra, and the formation of fatty acids at the expense of the oil-content.

Knowing what constitutes good copra, a glance at the following table is a sufficient exhibit showing the reasons for the inferior price received for Philippine copra. This table is taken from "Copra and Coconut Oil," by H. C. Brill, H. O. Parker, and H. S. Yates, in *Philippine Journal of Science* (1917), Vol. XII A, p. 57:

Table 1.—Moisture content of commercial copra in the Philippines.

Locality	Water	
	Maximum	Minimum
	Per cent.	Per cent.
San Pablo, Laguna - -	29·1	18·8
Lucena, Tayabas - -	23·1	14·5
Atimonan, Tayabas - -	24·7	15·5
Legaspi, Albay - -	22·2	17·6
Tacloban, Leyte - -	20·7	14·4

Where the climate permits, the copra is dried in the sun in the Philippines. However, in the most prominent coconut regions, as in Laguna, Tayabas and Mindanao, the sky is often so overcast and rains are so frequent that sun-drying is out of the question. Here the copra is dried in the *tapahan*, which is an oblong pit on the top of which is built a grill of

bamboo, leaving one end of the pit open, at the bottom of which a fire is made. The raw coconut meat is placed on the grill, the fire is lighted, and the hot air and smoke passes upward through the grill and so dries (and smokes) the meat. The copra made in this way is commonly insufficiently and unevenly dried, and as a matter of course, becomes dark and discoloured from the smoke. In other words, it is of inferior quality, and consequently fetches a low price.

At the present writing, in the local market *tapahan*-dried copra is sold at from 10·62 pesos to 11 pesos per picul, the sun-dried copra sells at 11·62 pesos to 11·75 pesos, and ex-godown copra at from 12 pesos to 12·25 pesos per picul (1 picul=63·25 kilos). Comparing now only the domestic grades, with an average yield of 24 piculs of copra to the hectare per annum, this represents an annual loss of 22·88 pesos per hectare per annum owing to the use of the *tapahan* drier. Since on an area of 200 hectare this amounts to 4,576 pesos, the installation of a Patalon drier at a cost of 2,800 pesos including bodega, would pay for itself and leave a profit of 1,776 pesos the first year.

On most coconut plantations in the Philippines the nuts are first husked by hand, and consequently split before drying, but at the Polo, Bioos, and the Montenegro plantations, Dumaguete, Oriental Negros, splitting the unhusked nut with a broad axe or a heavy bolo, after which the meat is pried out with a curved knife, has been adopted as being a more economical procedure, as it eliminates the cost of husking.

At the Polo Plantation, the expense of hauling the nuts from the field to the drier has been still further reduced by splitting the collected nuts in the fields, and removing the meat from them on portable platforms which are carried from one block to another as the work proceeds, after which the coconut meat is bagged and brought to the drier in wagons or trucks. The husks are scattered in the field, and ploughed under. In this way nothing is removed from the field except the coconut meat, which is a very light drain upon the fertility of the soil, the productivity of which, it would appear, could thus be maintained unimpaired for many years without the aid of fertiliser.

In drying by the sun the halved nuts usually are first spread on the ground, and as the drying proceeds the meat is collected and placed on palm-leaf mats.

In the rainy coconut districts artificial driers will, of course, be imperative, but in those regions where the bright days are sufficient to render the perfect drying of the meat practicable, for instance in Cebu and Bohol, sun-drying is particularly well adapted to the needs of the small, individual producer, for sunlight and heat may be had without the asking. However, in order to produce a better and cleaner copra, the present custom of spreading the coconut meat upon the ground should be discontinued. Trays should be made of bamboo, upon which to place the meat for exposure in the sun the same as is done in drying fish. Not only would copra prepared in this way command a premium because of its cleanliness, but the handling of the meat itself from the time of placing it in the sun until sacked would be facilitated; in the case of threatening rain it could easily and rapidly be placed under shelter. Such trays might be made of any convenient size for two men to carry, one at each end of the tray. Since bamboo grows everywhere the cost of making these trays would not be

great. With reasonable care they would last a long time, and they could be made by the producer himself at a very low initial cost. A tray 2 by 1 meter is suggested as a suitable and convenient size. As these trays, filled with coconut meat, are placed in the sun for drying they should not be spread upon the ground, but raised therefrom by the means of scantlings or bamboo upon which they are placed; this would insure clean copra, and by the better circulation of air hasten the drying. The drying ground should of course have a shed where the trays can be stacked in case of a sudden rain and for the storage of the dried copra. The producer will do well to always keep in mind that dry, clean copra is equivalent to top prices. The floor of the copra bins should therefore always be well raised above the ground to prevent access of water, which induces the formation of moulds. The copra should never be stored on the ground, unless it be on a concrete floor. An open, ventilated bamboo floor, not less than 50 centimeters above the ground, would serve the purpose well.

In the largest coconut-growing areas, however, the planter must reckon on the installation of an artificial drier, if, as he should, he desires to produce a high-grade copra.

In the case of the small planter the obvious course to pursue would be either to sell his nuts or to organise a co-operative drying enterprise.

Before breaking ground for a co-operative drying plant, a careful estimate should be made of the annual yield of nuts in the prospective tributary area in order to avoid waste and the installation of a disproportionate amount of machinery. The importance of this preliminary work cannot be overestimated, since the more nicely the available supply of nuts is adjusted to the full capacity of the drying plant the lower will be the operating expenses. Distance and transportation costs should be carefully considered.

Attempts were made a few years ago by the Bureau of Science to dry copra by exposing the coconut meat to sulphur fumes, and while this attempt failed, it was found that the sulphuring of the meat was advantageous in that it prevented the formation of moulds and hastened the drying of the meat. The field experiments were conducted at Polo where the sulphuring of the coconut meat has become a part of the routine in the copra manufacture for more than a year, as it is also on the Montenegro plantation.

The sulphuring box, as built by Mr. Detrick, is 275 centimeters long, 125 centimeters wide, and 210 centimeters high. It has a false bottom, made of slats through which the fumes can pass easily, about 15 centimeters above the floor, under which there is space for a shallow tin pan containing the sulphur.

The gunny bags containing the coconut meat brought from the fields are piled in the box and the sulphur is ignited, after which the door is closed. The coconut meat is exposed to the sulphur fumes for 4 hours, after which it is run through a cutter to chop the meat into a smaller size, which permits uniform and more rapid drying of the copra than if the meat was dried as it comes removed from the nuts in large pieces.

The sulphuring box which is air-tight, of course, has been built at a cost of less than 40 pesos. With sulphur selling at 40 centavos per kilo, the meat from approximately 3,000 nuts can be treated at one time at a cost of less than five centavos ($0.025 U.S. currency) per picul of dry copra, one and a half to two kilos of sulphur being required for each treatment.

Sulphuring is recommended as a cheap, effective, and practical preventative for moulds affecting copra and should be applied to the fresh meat before drying. It does not injure the quality of the coconut oil, and hastens the drying of the copra.

FIBRES.

PRODUCTION OF HENEQUEN FIBRE IN YUCATAN AND CAMPECHE.

The following extracts are taken from the United States Department of Agriculture—Department Bulletin No. 1278 on "Production of Henequen Fibre in Yucatan and Campeche" by H. T. Edwards, Specialist in Fibre-Plant Production, Office of Fibre-Plant Investigations, Bureau of Plant Industry.

INTRODUCTION.

Henequen (*Agave fourcroydes* Lem.) fibre has been imported in steadily increasing quantities into the United States during the past 40 years. The average annual imports of this fibre, which were 40,000 tons during the 5-year period 1887-1891, had increased to an annual average of 148,000 tons during the 4-year period 1918-1921.

The two features of the henequen situation of special interest to the American farmers are that this fibre constitutes the main source of supply of the raw material used for the manufacture of binder-twine and that practically all the henequen imported into the United States is obtained from the States of Yucatan and Campeche. The condition of their henequen industry therefore has a very important bearing on the welfare of the grain-producing industry of the United States.

OUTLINE OF THE BINDER-TWINE FIBRE SITUATION.

The United States consumes annually from 100,000 to 150,000 tons of binder-twine and exports from 30,000 to 50,000 tons.

This twine is manufactured from henequen, sisal, abaca (pronounced a-ba-ka; Manila hemp), maguey, istle, and phormium (New Zealand flax) fibres. Henequen fibre, with the exception of a very small quantity, is obtained from Yucatan and Campeche; the sisal principally from Java, East Africa, and the Bahama Islands; the abaca and maguey from the Philippine Islands; the istle from Mexico; and the phormium from New Zealand.

During recent years, because of unsettled conditions both on the plantations and in the world markets there has been considerable variation in the relative quantities of these different fibres used for binder-twine purposes. For a long period, however, Yucatan henequen has been the principal fibre used for the manufacture of binder-twine.

During the 10-year period, 1911-1920, the average annual imports of henequen and sisal into the United States were 163,703 tons, valued at $28,507,956. The greater part of this fibre was used for the manufacture of binder-twine, and for many years more than 90 per cent. of the combined total imports has been henequen.

From 1915 to 1921 the available supply of this fibre was irregular, there was a great fluctuation in the price, and the market was very unsettled.

Since January 1, 1922, the production, although much less than that of earlier years, has been fairly regular, and a stable price has been maintained.

Even with a gradual improvement of conditions in Yucatan, there is likely to be a shortage of henequen fibre for several years. Since there is no probability of any marked decrease in the world consumption of binder-twine, any shortage in supply of henequen fibre must be met by an increased production of other fibres suitable for binder-twine purpose.

IMPORTANCE OF HENEQUEN IN YUCATAN.*

The production of henequen is by far the leading industry of Yucatan. In value this fibre constitutes about 85 per cent. of the total exports, and others of importance being chicle gum and hides.

Both soil and climatic conditions are peculiarly well adapted to the cultivation of henequen, whereas they are ill adapted to the cultivation of most of the other staple crops of the Tropics. Under these circumstances the maintenance of the henequen industry in a prosperous condition is a matter of vital importance to the people.

CLIMATIC CONDITIONS.

The climate of Yucatan is tropical, the lowest recorded temperature being 48°F. The precipitation is relatively low, approximately 30 inches per annum, and there is a long dry season. These conditions are favourable for henequen, although occasionally during an exceptionally long dry season even this hardy plant suffers some injury. It would be difficult to find any other staple tropical crop so well adapted to the climatic conditions of the northern part of the State.

SOIL CONDITIONS.

In the area utilized for the production of henequen the surface is relatively flat, slightly rolling, and somewhat broken. The soil is largely composed of a porous, partially decomposed limestone in which there are numerous pockets and in places a thin fertile covering. The land is so rocky that trees cannot be planted until holes have been blasted for them to grow in, and frequently even the small henequen suckers are propped up with small stones in places where there is practically no soil. Under these conditions the profitable cultivation on a commercial scale of any other crop would be exceedingly difficult if not impossible. These unusual soil conditions, however, are practically ideal for henequen.

Although it will thrive on land having but little soil, there are kinds and degrees of "rockiness" favourable and unfavourable for this plant. For instance, the soil conditions in the vicinity of the town of Motul are regarded as exceptionally favourable, for the reason that in this section the soil is filled with medium-sized and small rocks rather than having the unbroken strata of rock found in certain other localities.

The soils found in the eastern and southern sections of the henequen areas of Yucatan and in Campeche are more fertile and less rocky than the soils of north-central Yucatan, which is the principal producing region. Most of the planters believe that the fertile soils are not favourable for henequen. One objection to its cultivation in such soils is the increased cost of keeping down the weeds and under-growth which grow very quickly in this country even on rocky lands.

* This report is based on field investigations made in Yucatan and Campeche during June and July, 1923, by H. T. Edwards, who wrote it immediately upon his return. Important changes have taken place since.

GEOGRAPHICAL DISTRIBUTION

Henequen is widely distributed throughout a large portion of the States of Yucatan and Campeche, but the principal fibre-producing area is a district which extends for about 60 miles south of Progreso and approximately the same distance east of Progreso and Merida. The town of Motul, about 30 miles north-east of Merida, is the centre of one of the largest and most prosperous henequen-producing sections. The conditions in this district are specially favourable. Good yields are obtained, and the fibre is of excellent quality. Many of the lands lying between Merida and Progreso are planted to henequen, and there are a number of large plantations south of Merida. A large part of the lands lying on both sides of the railway between Merida and Temax is planted to henequen. To the north, between Temax and the sea, the henequen belt extends somewhat farther to the east. Along the seacoast east of Progreso and north of Merida, Motul, and Temax there is a belt of jungle land, roughly from 3 to 5 miles wide. Throughout this uncultivated area are many scattering plants of wild agaves, including henequen apparently introduced from the plantations and other species that may be indigenous. Henequen is not known as an indigenous plant.

AREAS PLANTED

There is considerable variation in the figures furnished by different native authorities on the total area planted to henequen, the relative areas in large, medium, and small plantations, and the relative areas in old, medium, and young plantings.

The Comisión Exportadora de Yucatan, which handles all the fibre and is in closer touch with the industry in Yucatan and Campeche than any other agency, estimates the total area planted to henequen in these States as 5,400,000 mecates,* which is equivalent to 216,000 hectares or approximately 540,000 acres, of which 40 per cent. is in large, 30 per cent. in medium, and 30 per cent. in small plantations. The large plantations range in size from 3,000 to 6,000 acres. The "San Francisco" in the Motul district, said to be the largest plantation in Yucatan, has approximately 6,500 acres planted to henequen.

Only an approximate estimate can be made of the relative areas in young, medium, or producing, and old plantings. Such an estimate in July, 1923, indicated that about 50 per cent. of the total area, or 270,000 acres, was in the producing state; about 40 per cent. or 216,000 acres, in plantings 2 to 6 years old; about 8 per cent. in plantings less than 2 years old; and about 2 per cent. in old fields that had ceased to be profitable.

The total number of henequen plantations in Yucatan is variously reported to be anywhere from 200 to 850, according to what is considered a "plantation." There are probably between 500 and 800 properties which may properly be so regarded. One report shows a total of 550 plantations, of which 19 have an annual production in excess of 500,000 kilos (over 1,000,000 pounds) of fibre, 75 an annual production in excess of 100,000 kilos of fibre (more than 200,000 pounds), and the remaining 456 a smaller production. The total exportation of henequen fibre from Yucatan during 1923 was 612,745 bales, or approximately 248,000,000 pounds, of fibre.

* The mecate, which is approximately one-tenth of an acre, is the unit of surface measurement used in Yucatan.

More accurate statistics of acreage with respect to the age of the plants would be desirable as a basis for estimating the production during the next six years. The young plants do not yield fibre until six or seven years after they set in the field, and the old plants yield reduced quantities, so that under normal conditions it is not profitable to harvest leaves from them.

COST OF PRODUCING HENEQUEN FIBRE

With the fluctuating cost of labour and the wide variation in conditions on different plantations, it is difficult to obtain data that will satisfactorily show the average cost of producing henequen in Yucatan at the present time.

One itemized statement prepared by a planter shows a producing cost of 2·6 cents United States currency per pound. An estimate furnished by another planter shows a producing cost of 3 cents per pound. It has been stated that the producer who receives 3½ cents per pound for the fibre at the plantation can clean the fields already planted, harvest leaves, and prepare the fibre under existing conditions at a small profit. This profit, it is claimed by the planters, is not sufficient to provide funds for the planting of new areas or to encourage new planting.

PRESENT PRODUCTION

The production of henequen fibre in Yucatan and Campeche during recent years, according to data furnished by the Comisión Exportadora, has been as follows :

PRODUCTION FROM 1912 TO 1923

	Bales		Bales
1912 ...	814,610	1918 ...	768,723
1913 ...	836,950	1919 ...	664,972
1914 ...	964,862	1920 ...	953,034
1915 ...	949,639	1921 ...	626,980
1916 ...	1,191,433	1922 ...	434,038
1917 ...	733,832	1923 ...	612,745

CONDITION OF PLANTATIONS

The condition of the plantations in Yucatan in July, 1923, although by no means all that could be desired, appeared to be improving. Work of cleaning the abandoned and semi-abandoned fields had been organized, funds had been obtained for financing this work, and considerable progress was being made. Large areas still remained to be cleaned, however, and there were many fields so badly overgrown that they would have to be either replanted or abandoned altogether. The Comisión Exportadora stated that it was not possible to furnish data showing the areas in satisfactory condition, in poor condition and considered as abandoned.

The situation with respect to the planting of new fields was less satisfactory than the degree of progress that had been made in cleaning the fields. There were relatively large areas of henequen from 2 to 5 years of age, but comparatively little planting had been done during the preceding 18 months.

MARKET SITUATION

During the latter part of 1921 Yucatan henequen was selling at a price of 2¾ cents Gulf, that is delivered at New Orleans or Mobile. The market was in a badly disorganised condition, there were large stocks of unsold

fibre in the United States, the plantations in Yucatan were steadily deteriorating, and there existed a marked degree of uncertainty as to the future of the industry. Early in 1922 the Comision Exportadora de Yucatan, the selling agency of which in the United States is the Sisal Sales Corporation, assumed the direction and control of the marketing of practically the entire output of Yucatan and Campeche.

The efforts of these two organizations have served to stabilize the market and check the decline in production, at least for the time being. There has been collected, compiled, and co-ordinated a large mass of data regarding the henequen industry in Yucatan. These records show in great detail the organization, equipment, systems of management, and the results that are now being obtained on the plantations. The quality of fibre has been somewhat improved by maintaining in the warehouses at Progreso a system of grading and standardization. A considerable part of the stocks of old fibre has been sold, and a stable price in the world markets has been maintained.

The selling price of 6½ cents per pound for henequen, maintained with a variation of less than ¼ cent in this country throughout the years 1922 and 1923, is about ⅝ cent above the average price during the years 1890 to 1914. The prices of other hard fibres, abaca, African and Java sisal, and Manila maguey, varied somewhat, with an average net increase of nearly 1 cent per pound during the two years. The price of henequen, in comparison with the prices of these other fibres, indicated a relative market value approximately the same as that shown by quotations in pre-war years, falling below somewhat toward the close of the period.

The planter in Yucatan has received 3½ to 4½ cents United States currency per pound for the fibre delivered at Progreso. An export duty ranging from 1 to 1½ cents per pound is collected by the Government of Yucatan. The freight, exclusive of lighterage, from Progreso to New Orleans or Mobile is between 15 and 20 cents per 100 pounds, and 7 to 10 cents more to Philadelphia, New York, or Boston.

FUTURE PRODUCTION OF FIBRE

It has been estimated by the Comisión Exportadora that the production of henequen fibre in Yucatan and Campeche will be approximately 600,000 bales for 1923, 700,000 bales for 1924, and 800,000 bales for 1925, with a continued production of about 800,000 bales per annum for a number of years. Other estimates indicate that production may either fall below or exceed these figures.

There are a number of different factors in the henequen industry concerning which there is an element of uncertainty, any one of which may materially affect the future production of this fibre. Many of the larger planters are heavily in debt and are without necessary capital for the efficient operation of their plantations. There is a shortage of labour, a marked degree of restlessness among the plantation labourers, and constant fluctuation in the wage scale. Any marked increase or decrease in the world consumption of henequen or in the production of the different fibres which compete with henequen will materially affect the situation in Yucatan.

HENEQUEN IN CAMPECHE.

The State of Campeche adjoins Yucatan, and the production of henequen in these two regions may be regarded as essentially one industry. Although there are certain differences in the soil conditions and in the system of cultivation, the situation in these two countries is practically the same.

The henequen industry of Campeche has suffered even more severely than that of Yucatan during the past few years. The production of henequen fibre in Campeche, which was formerly about 50,000 bales per annum, is now only 20, 000 to 25, 000 bales, and the rehabilitation of the plantations in that State is proceeding rather more slowly than in Yucatan.

The soil is less rocky and more fertile than that of the henequen areas of Yucatan. In consequence, the Campeche plants grow more vigorously, but the weeds and brush also flourish. It is claimed by the Campeche planters that this fibre is in every respect as good as, if not superior to, the Yucatan fibre.

The labour situation is very unsatisfactory. There is a great shortage of plantation labour, and the wages are high. Many of the labourers who formerly lived in the country on the plantations are now moving into the towns. Increasing areas are being planted to food crops, and the labourers who have an abundant supply of food are not disposed to work on the henequen plantations.

An organized effort is being made to rehabilitate the industry. Funds have been loaned to the planters for cleaning and replanting their fields, and fairly satisfactory progress has been made in this work.

DELINTED AND RECLEANED COTTON-SEED.

The ultimate value of any process of improving the physical condition of seed is measured by the agricultural advantages accruing to the farmer who plants such seeds. Commercially, any operation of this kind must pay its own way and to do this the results must be reflected in either increased or more economical yields. Results obtained by some of the largest cotton growers from planting delinted and recleaned cotton-seed over a period of from three to eight years indicate clearly that the practice is worthy of universal adoption.

The following paragraphs on the agricultural advantages of delinting are taken, with slight modification, from a United States Department of Agriculture Bulletin :—

Delinting promotes a uniform stand of plants by enabling the seeds to germinate more nearly simultaneously and with the aid of less moisture. There is a wide variation in the quantity of lint left on individual ginned seeds and when planted the seeds with the shortest lint on them come into closer contact with the soil moisture and germinate more quickly than those containing excessive lint.

Closely delinted seeds contain a very small, uniform quantity of short lint or fuzz, germinate at practically the same time, and produce a more nearly perfect stand of plants at least two or three days earlier. This is of value in growing cotton under conditions of boll-weevil infestation because every day gained in getting the plants above the ground increases the prospects of obtaining a profitable yield.

Delinting assists materially in the emergence of cotton seedlings. Cotton-seeds in germinating, are forced up through the soil on the cotyledons of the young seedlings and a closely delinted seed offers less resistance than ginned seed. Also the united action of the young seedlings, resulting from the simultaneous germination of the delinted seeds, enables

them to break through soil that has been compacted by rains with comparatively little difficulty and helps to insure a stand of plants under adverse conditions.

Delinting effects an economy in the use of cotton-seed, as planting machines will distribute a smaller quantity per acre more evenly. It will eliminate the necessity of a force feed in planting machines and facilitate the single-seed distribution and the planting of cotton-seed in hills. The thin, uniform, and recleaned seed also may help to simplify the culture of cotton by what is known as the single-stalk method which, repeated experiments show, produces the highest yields and earliest maturity.

In few instances which have recently come to the writer's attention delinted and recleaned seed are being planted with corn, bean, or pea-nut planters now on the market in the South (United States) spacing the seeds the desired distance and effecting a saving of 25 to 50 per cent. of the seeds required per acre. Furthermore, the proper spacing of the seeds in the drill makes it easily possible to eliminate the expensive thinning or "chopping" operation in the cultivation of the crop. Thus the use of delinted and recleaned cotton-seed tend to lower the cost of production.

Any practice resulting in an increased yield with no additional cost also lowers the net cost of production per pound. In experiments conducted by the Bureau of Plant Industry in 1907 recleaned or graded seed produced from 8·25 to 10·9 per cent. more seed cotton per acre than seed not recleaned or graded. These seeds were rolled in some finely pulverised material sprinkled with water to paste down the lint or fuzz so that they would separate readily. The addition of water and foreign material introduces a possibility of error in separating the light-weight and heavy-weight seeds which is not encountered when recleaning seeds that have been delinted closely. With the added advantages accruing from planting delinted seed there is no apparent reason why such seed when efficiently recleaned should not give even greater results than those in the experiments referred to.

Thus it appears that delinted and recleaned cotton-seed may be made available to the farmer at no additional cost for the quantity required per acre and that the use of this seed adds to the net returns from the crop both reducing the cost of production and by increasing the yield per acre. However, satisfactory results may be expected only when the seeds are delinted closely and then recleaned efficiently. Delinting, although a valuable factor in improving cotton-seed for planting purposes, is not sufficient in itself, and recleaning cannot be done economically or efficiently unless the seeds are first delinted. The two processes are interdependent and when properly employed in conjunction with each other they offer marked possibilities for the advancement of the cotton-growing industry.

SUMMARY OF CONCLUSION.

Cotton-seed may be delinted very closely with not over 1 per cent. saw-cut injury. From 103 to 150 pounds of linters per ton of seed may be removed with safety. When delinted at the high rate very little linters or fuzz is left on the seeds and greater benefit is derived from the operation both as to duration required for germination and to efficiency in recleaning.

Delinting greatly accelerates the germination of cotton-seeds. Under ideal conditions of moisture and temperature a full germination may be obtained with delinted seeds in two days less time than with ginned seeds, while under conditions of a deficiency of moisture the difference in duration in favour of the delinted seed is much greater.—Farmers' Journal, Vol. VI. No. 46.

SOILS AND MANURES.

ARTIFICIAL FARMYARD MANURE.

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and

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As a consequence of the campaign for increased production during the War, and the resulting extension of the area under cereal crops, it was thought that, even after making allowances for disposal through the usual channels, there might still remain a surplus of straw which could not be utilised for feeding or for conversion into manure. It was therefore determined to investigate the possibility of converting straw into manure without the intervention of live-stock, and a special grant in aid of the investigation was made to the Rothamsted Experimental Station by the late Food Production Department. Apart from war conditions, the possibility of adding to the supply of organic manure deserves consideration. In the case of market gardens particularly, the difficulty of obtaining adequate supplies of stable manure is increasing. The investigations described below indicate a method by which straw can be converted into a substance having many of the properties of stable manure. Further experiments to test the economic value of the process when conducted on a large scale are in progress at Rothamsted. Lord Elveden has also generously provided assistance and facilities for experimental work on his Pyrford Estate.

Of a considerable number of preliminary experiments to secure obvious breakdown and colour changes in fermenting straw, the most promising results were obtained when straw was subjected to the action of a culture of aerobic cellulose-decomposing organisms (e.g., *Spirochaeta cytophaga*). Further enquiry showed, however, that this effect was not due simply to the provision of an organism capable of breaking down cellulose, but rather to the indirect effect of the mineral substances contained in the culture fluid. From this point on, the question of food supply—as distinct from the addition of any particular species of organism—received special attention, and, as will be seen later, led to results possessing both theoretical and practical importance.

Without entering into a detailed account of the various stages of the investigation, we may state here that the most essential factors making for the production of well-rotted artificial farmyard manure are air supply, suitable temperature, and a suitable supply of soluble nitrogen compounds.

(1) *Air Supply.*—It has been found invariably that characteristic breakdown changes in straw remain suspended when a free supply of air is excluded either by intense consolidation or by immersion of the straw in liquid. The fermentation appears, therefore, to be an essentially aerobic one, at least in its early stages, and the typical disintegration of the straw

with the production of dark-coloured plastic material does not take place in the absence of air. Moreover, the colour of aerobically produced manure is rapidly reduced when oxygen is excluded. The great importance of air supply is shown by the following experiment, in which four lots of straw were fermented under aerobic and anaerobic conditions for three months at 37°C. (99°F.).

Loss of dry matter.

	Straw without Nitrogen.	Straw with Nitrogen.
Without Air Supply	16·3 per cent.	17·1 per cent.
With Air Supply	40·1 „	59·8 „

The data explain what may be seen in the ordinary heap of farmyard manure, viz., that straw submerged in liquid urine, and therefore protected from air, remains in an unchanged state for long periods. On the other hand, the practice of carting manure from the yards and boxes and storing it in heaps in the field, although carried out for other reasons, provides better conditions for rotting than are likely to prevail where the dung is consolidated by trampling and saturated with urine.

(2) *Suitable Temperature.*—Except in those cases where straw is being fermented under otherwise unfavourable conditions, special measures to maintain a favourable temperature for fermentation are not called for. In common with other fresh fermentable materials, moist straw rapidly undergoes a preliminary fermentation during which the temperature may rise to upwards of 65°C. (149°F.). It is, however, in the subsequent stages that the effect of treatment becomes most evident in maintaining the temperature. Experience has shown that a supply of nitrogen, by increasing the energy of fermentation, leads to an increase of 15-20°C. (59-68°F.) in favour of straw which has received a sufficient supply of nitrogen, as compared with untreated straw.

(3) *A Supply of Soluble Nitrogen Compounds in suitable Concentration, and possessing a neutral or slightly alkaline reaction.*—Repeated experiments have shown that the most rapid breakdown of straw occurs when some source of nitrogen in an available or indirectly available form was supplied, and then only in those cases where the reaction of the solution was neutral or slightly alkaline. Hence the supply of nitrogen in the ammonium sulphate alone fails to lead to definite breakdown since the medium soon becomes markedly acid, while, on the other hand, the supply of an alkaline compound alone, such as caustic soda, is equally ineffective, since a source of nitrogen is lacking. The addition of nitrogen in the form of urine, urea, ammonium carbonate, or peptone within certain concentrations immediately sets in train rapid decomposition changes, and results within the period of a few weeks in the production of dark-coloured, well-disintegrated, structureless material closely resembling well-rotted manure. That this should be the case with urine was perhaps not remarkable, although the factors which operate in the essential dung-making process had not then been individually worked out, but that an essentially characteristic product could be obtained without the use of urine or of the fæcal portion of the manure as ordinarily produced was at once suggestive. On the basis of subsequent work, it may indeed be claimed that, in the production of normally well-rotted farmyard manure, the mass inoculation

of the litter with the large bacterial population of the fæces does not exert any marked contributory influence on breakdown changes; that the urine, as such, apart from being the carrier of nitrogen, does not induce any characteristic changes in the straw, while the typical smell and colour of stale urine from the manure heap may be successfully reproduced from straw treated with ammonium salts.

Although it is important that available nitrogen should be present for the rotting process, it is also not less essential that the quantity of nitrogen should not exceed a definite amount both actually as well as in concentration. In other words, if the concentration of ammonium carbonate produced from the decomposition of urine or urea exceeds a definite limit not only are straw-breakdown changes definitely held up, but they continue to be inoperative until by volatilisation, and consequently loss of nitrogen to the air, the concentration or alkalinity has been reduced to the upper limit of growth of micro-organisms. *This must be regarded as particularly important, since the highest concentration for rapid breakdown is appreciably below that of the weakest undiluted urine.*

It follows that it is quite impossible to produce well-rotted dung by the use of neat urine without considerable losses. This fact may be illustrated by the following table, and, incidentally, is shown by all the investigations that have been carried out on the making of farmyard manure.* Three equal portions of straw were saturated either with water or urine and allowed to ferment for three months in the laboratory, the two portions with urine being subjected to different temperatures. As will be seen from the following table, these two portions fermented to different degrees—the dry matter losses being 49 and 60 per cent. respectively, *but the final nitrogen-content was almost identical*, and practically three-fourths of the nitrogen supplied as urine was lost.

	Temp.	Loss of dry Matter. per cent.	Nitrogen Initial mgrm.	Nitrogen Final mgrm.	Loss—or Gain+ mgrm.
Straw with water	(36°C.=97°F.)	40·1	71	97	+26
Straw ,, urine	(26°C.=80°F.)	49·1	507	178	—329
Straw ,, ,,	(36°C.=97°F.)	59·8	507	176	—331

It would be erroneous, however, to assume that such losses are inevitably connected with a satisfactory breakdown of straw, or that the conditions ordinarily obtaining in the farmyard at all represent optimum proportions between the straw which is to be decomposed, and the concentration of nitrogen in the urine which eventually serves for this decomposition. That equally good rotting may be obtained without loss of nitrogen is shown by the cases given in the table below. In the experiments to which the table refers, straw was incubated with urine in different concentrations for periods up to 86 days. Even after this period the losses that occurred with satisfactory rotting and within the lower concentrations were only about 4 per cent. of the total nitrogen of the final product. The ordinary losses of the manure heap are frequently more than tenfold this amount.

* See, for example, Russell & Richards, Journ. Agric. Sci., 1917, Vol. VIII, p. 495.

	Number of Experiment.				
At beginning	(1)	(2)	(3)	(4)	(5)
Straw and urine nitrogen	77·5	157·6	237·6	317·6	397·6
After 86 days					
Total nitrogen	77·3	153·1	226·8	262·1	308·0

In addition to *the two phases already mentioned*, (*a*) in which straw overloaded with nitrogen loses it to a definite degree, and (*b*) in which straw with the requisite amount of nitrogen may undergo rotting without appreciable loss and is therefore in a state of equilibrium, there exists *a third phase* in which under-saturated straw, by the agency of micro-organisms, exhibits a well-marked property of picking up nitrogen, particularly in the form of ammonia, until the same final content of nitrogen in the rotted product is attained. Hence we might expect that in two different but adjacent portions of fermenting straw, the one overloaded with, and the other lacking, nitrogen, the former portion loses and the latter accumulates nitrogen until a common level is approached. That such is actually the case is illustrated by the following data. Ten portions of straw were moistened to the same extent, and while one received water only, the others received additions of soluble nitrogen in the form of urea in varying quantities, until the last portion was saturated with a solution similar in concentration of nitrogen to that of horse urine (1 per cent. of nitrogen.) The different portions were then kept in an incubator for 3 months, at the end of which time it was evident that, contrary to expectation, the straw, without, or merely with low doses of nitrogen, had passed through a marked rotting process. On analysis, however, it was found that there had been a definite accumulation of nitrogen in the lower members of the series, while the higher members had lost in some cases the greater portion of their original nitrogen.

The Decomposition of Straw in the Presence of Varying Quantities of Nitrogen as Urea.

	Number of Experiment.									
Treatment	1	2	3	4	5	6	7	8	9	10
At beginning										
Straw nitrogen mgrm.	71	71	71	71	71	71	71	71	71	71
Urea nitrogen ,,	—	5	10	24	48	97	243	486	729	973
Total nitrogen ,,	71	76	81	95	119	168	314	557	800	1,044
At end of 3 months										
Organic nitrogen mgrm.	180	177	174	190	192	171	245	269	181	134
Ammonia ,, ,,	—	5	2	4	4	29	74	68	71	76
Total ,, ,,	180	182	176	194	196	200	319	337	252	210
Gain or loss ,,	109	106	95	99	77	32	5	—220	—548	—134
Dry Matter, loss per cent.	49	46	45	49	47	53	51	48	19	14

In seven out of the ten cases the final nitrogen of the fermented straw varied only between 180 and 210 mgrm., irrespective of the nitrogen-content of the original mixture. It should also be noted that the extent of the rotting, *i. e.*, the loss of dry matter, in experiments 1-8 was very much

greater than in 9 and 10 in which the straw was subjected to the action of solutions closely approaching the concentration of ordinary urine, the high alkalinity of the latter exercising a check on decomposition.

In the main, the nitrogen retained by super-saturated straw, or such as is accumulated by under-saturated straw, as in Nos. 1—6 in the above table, appears to be stored up in an organic or non-ammoniacal form. The maximum retention has been found to occur within the first four weeks, after which time breakdown of this organic nitrogen to ammonia and consequent loss by volatilisation seems to keep pace with loss of dry matter. Finally, the material assumes a "stabilised" condition—the loss of nitrogen becomes greatly diminished or may be absent altogether for long periods. Between the 60th and the 120th day little change is found to take place either in the amount of "stabilised" or "fixed" nitrogen or the proportion of this nitrogen and the ammonia which appears to be held by fermented material even at a high temperature (37°C. = 99°F.), and in spite of the frequent handling and exposure associated with sampling operations. In general, it may be stated that when straw has worked from an unsaturated to a "stable" phase little or no free ammonia is to be found, but straw which commences with a super-abundance of nitrogen appears to hold, when in a fermented state, upwards of 14 per cent. of its nitrogen in the form of ammonia so long as the material is in a moist condition. Desiccation leads almost to complete loss of ammonia, and in this respect as well as in the proportion of ammonia in the moist material, the artificial resembles the natural manure.

From the study of the inter-relations between nitrogen and straw, we have come to the conclusion that the amount of nitrogen necessary for pronounced rotting, and the amount which straw is capable of "fixing" in the form of ammonia are identical, and that, in general, the figure varies only between 0·70 and 0·75 parts of nitrogen per 100 parts of dry straw. Within these limits fermentation proceeds without loss of nitrogen, and it is obvious that, except in so far as the nitrogen-content of the original straw varies, the final "stabilised" product obtained when rotting has proceeded to the extent of 40 to 45 per cent. of dry matter must likewise exhibit comparatively slight variation in its nitrogen-content. In our experiments the "stabilised" product obtained from the fermentation of straw under a variety of conditions possesses a nitrogen-content of about 2 per cent. calculated on the dry material.

It thus becomes possible to estimate fairly accurately what the nitrogen-content of any particular sample of fermented straw will be when rotting has proceeded to an appreciable extent. If, for example, the nitrogen-content of the original straw is equal to 0·50 per cent., and we assume that the theoretical amount of ammonia nitrogen, equal to 0·72 lb. or nitrogen for 100 lb. of straw, has been fixed, then, with a loss of 40 per cent. of dry matter during fermentation, the resultant-rotted straw will contain $(0{\cdot}50 + 0{\cdot}72) \times 100 \div {\cdot}60 = 2{\cdot}03$ per cent. of organic nitrogen in the dry matter. An additional amount of ammonia nitrogen would probably result in a portion remaining as free ammonia which, as indicated above, would be liable to loss if the fermented straw were allowed to become dry. The data thus obtained enable us to turn to the process of

inducing the fermentation of straw on a large scale, and are also capable of application to the conditions operating in the production of ordinary farmyard manure.

*Suggested Method for the Preparation of Artificial Manure.**—As regards large scale work, a number of factors have to be taken into account which did not operate in the laboratory experiments. Experience has shown that urea and ammonium carbonate are the most suitable carriers of nitrogen since they ensure a favourable alkaline reaction, and lead to rapid break-down, provided that they are not present in large excess. They are, however, far too expensive at the present time to admit of general use in farm work, although a reduction in the cost of manufacturing synthetic urea would create conditions favourable to its extended use. As an alternative source of nitrogen, cyanamide (nitrolim) and sulphate of ammonia have been used with success. Whilst cyanamide already contains sufficient free lime to keep in check any acid compounds formed during fermentation, sulphate of ammonia must be supplemented by the addition of a base, and for this purpose finely-ground chalk, ground limestone, or waste lime from causticising plant at soap works may be used. For general purposes it will be found that upwards of $\frac{3}{4}$ cwt. of sulphate of ammonia and 1 cwt. of finely divided carbonate of lime per ton of straw are sufficient to induce fermentation. The main obstacles to large scale operations at the present time arise from the great tardiness with which raw straw takes up the moisture necessary for fermentation. Where pits are available this difficulty may be overcome by allowing the straw to remain immersed for 2 to 4 days, after which the free liquid may be drained off. In the case of heaps or stacks on open ground no advantage appears to be obtained by continued wetting with large quantities of water, and we suggest, as a more effective method of securing the necessary saturation of the straw, sprinkling the heap comparatively lightly with water and allowing a couple of days to elapse before a second sprinkling is given. During this time a slight fermentation with increase in temperature sets in, rendering the straw more capable of absorbing a second slight application of water than would otherwise be the case. When examination has shown that the interior of the heap has become uniformly moist, the source of nitrogen may be applied in the form of solution, or in the case of cyanamide and other products, this may be broadcasted over the surface of the heap and watered in. The most convenient method of making the heap, wetting the straw, and supplying the necessary nitrogen for fermentation depends so much on local conditions that much must be left to the initiative of the farmer himself.

General Characteristics of Artificial Farmyard Manure.—Artificial farmyard manure prepared from straw is a well-disintegrated plastic material in which the tubular character of the straw has been to a great extent destroyed. There is an almost complete absence of smell, the little there is being slightly fusty or mouldy in character. When prepared through the agency of a compound in the presence of free lime, there is a tendency towards the production of a blackish colour, while if prepared from soluble alkalies such as ammonium carbonate, liquid ammonia, or compounds giving free ammonia

* This process, as well as its application to the purification of sewage, has been covered by letters Patent (British Pat: No. 152387).

such as urea or peptone, or in the presence of sodium hydroxide or sodium carbonate, the colour is dark brown, and differs only slightly from the natural product. The liquid which is gradually expressed from the fermenting straw as more and more dry matter is lost by fermentation, has a dark-brown colour and a smell which is indistinguishable from stale urine.—The Journal of the Ministry of Agriculture, Vol. XXVIII, No. 5.

SOME NITROGENOUS PLANTS.

G. J. PICKTHALL.

In publishing the following photographs of some nitrogenous plants from my collection taken in Java, Sumatra and latterly in Ceylon, I do so with the hope that they may help to stimulate the growing enthusiasm that is being shown over green manures and the vital questions of soil erosion and anti-wash in Ceylon.

It is not my intention to write fully on the merits of these different plants as much has already been done so by abler pens than mine.

I have waited until I was able to take photographs of some of these plants growing in Ceylon on washed out laterite soil in the Low Country, some of it old abandoned fern land, in contrast with the rich volcanic soil of the Dutch East Indies.

It is of course obvious that these plants must receive a certain amount of care and attention, coupled with a certain amount of expense during the initial stages of planting; but surely these are worth it when considering the vast sums that are annually spent on artificial manures which do not make soil but which nitrogenous plants do.

I have heard the contention that some of these plants may cause difficulties from snakes, leeches, snails, etc., etc. :—but on the estates on which these photographs were taken I have not as yet heard of any such complaints, even so I do not think that such difficulties would be altogether insurmountable.

NOTES BY THE EDITOR.

Centrosema Plumieri (Plate I). This species has been naturalised in Ceylon for many years, and may be found growing wild in waste scrub from Colombo to Kandy. On the Experiment Station, Peradeniya, it grew rather slowly, but when once established it formed a satisfactory and permanent ground cover. It produces seeds somewhat sparsely at this elevation. It grows best in well-drained soil and will not stand water logging.

Vigna oligosperma (Plates II, III). When this plant was first used as a green manure, it was called *Dolichos Hosei*. Subsequently it was determined that it was a *Vigna*, which had been named *Vigna oligosperma*. Consequently these two names refer to the same plant. Recent writers, however, have used another combination, viz., *Vigna Hosei*. Whether this is correct or not depends on the relative dates of the two previous christenings, and the information at our disposal is insufficient to decide the point.

CENTROSEMA PLUMIERI. JAVA.

CENTROSEMA PLUMIERI. 1 year old. JAVA.

Plate II.

VIGNA OLIGOSPERMA. CEYLON Laterite soil.

VIGNA OLIGOSPERMA. SUMATRA.

VIGNA OLIGOSPERMA. CEYLON. Laterite soil.

MUCUNA CAPITATA. CEYLON.

CALOPOGONIUM MUCUNOIDES. CEYLON.

CALOPOGONIUM MUCUNOIDES. CEYLON. Same as above, distant view.

CALOPOGONIUM MUCUNOIDES. SUMATRA.

PHASEOLUS. LUNATUS. CEYLON.

CROTALARIA ANAGYROIDES.
(GIANT CROTALARIA). CEYLON.

PHASEOLUS LUNATUS. CEYLON.

The upper illustration on Plate II, shows this plant growing on old fern land on laterite soil. That on Plate III shows the plant on the same soil, belts of it having been taken up along the contour for propagation.

This plant is reported to grow well under old rubber.

Mucuna capitata (Plate III). This is one of the large-leaved beans a relative of the well-known Cowhage (*Mucuna pruriens*). It is closely allied to the latter, and is sometimes considered to be merely a cultivated form of it. It is found in India and Java, but has not been recorded for Ceylon. Four species of *Mucuna* occur in Ceylon, but not this one. It differs from *Mucuna pruriens* in that the bristles on the pod are shorter and deciduous. Whether the bristles on the pod of this species are irritating or not, as they are in *Mucuna pruriens*, does not appear to have been recorded.

Calopogonium mucunoides (Plates IV, V). When this plant was first proposed as a green manure, it was referred by mistake to *Glycine javanica*. The latter, which grows wild in Ceylon, is a different plant, and in Ceylon at least, scarcely affords sufficient material for the purpose. *Calopogonium mucunoides* is native to South America.

Phaseolus lunatus (Plates V, VI). This is known as Kratok in Java. It is the well-known Lima Bean, which is cultivated throughout the tropics.

Crotalaria anagyroides (Plate VI). This is known as the giant *Crotalaria*, and is said to give a larger weight of plant-food per acre than any of the other workable leguminous plants. It is a South American plant.

INDIGOFERA ENDECAPHYLLA.

T. P. M. ALEXANDER.

There are thirty-one known species of Indigofera in South India which can all be classed as under-shrubs, some erect and some trailing. *Indigofera endecaphylla* is of the latter form.

The following is a brief description of the plant given by J. S. Gamble in his "Flora of the Presidency of Madras":—Leaves imparipinnate; Leaflets 7-13: side leaflets alternate, oblanceolate, up to 1 in. long, usually from 9 to 12: stipules lanceolate, scarious: racemes up to 4 in. long, many flowered, flowers small under 0·3 in. long: purple-pink in spikes, each flower pedicelled in the axil of a caducous bract: pod linear-cylindric, 0·75-1 in. long, much deflexed, tetragonous, straight, 6-10 seeded.

This plant sends out trailers of about 6 ft. in length having adventitious roots. Its natural habitat is at an elevation of about 3,000 ft. but is known to thrive well at varying altitudes from sea level to 6,000 ft. Of all cover plants yet discovered, it is probable that *Indigofera endecaphylla* gives the heaviest amount of green mulch. Being a trailing plant, it does not tend to climb up tea or rubber and does not interfere with coolies walking over the ground as it has no thorns. It offers a thick mat which protects the ground from the baking rays of the sun in dry weather and soil erosion in the monsoons. *Indigofera endecaphylla* is propagated either from seed or

cuttings, but is established quicker from the latter. Cuttings of 6 inches in length dibbled into the ground at 2 ft. spacing should form a cover in 6 months. It stands heavy pruning at all times of the year, but preferably this should be done in April after the plant has seeded. Flowering takes place in November and seeds mature in January to February. From a field planted in June 1923 and pruned for the first time in November 1924, mulch to the extent of 11,157 lbs. has just been taken.

The method employed in cutting this in rubber is to get coolies with scythes who cut and roll the Indigofera trailers towards them. When a sufficient quantity of this is got, it is taken and put in level trenches or left on the ground in the form of a terrace. In tea one cooly per line is enough to roll and cut the trailers, which can either be buried or made into terraces. Grown in tea, this plant is kept low by pluckers walking over the ground.

SILANI: A NEW COVER AND FORAGE CROP FROM THE PHILIPPINES.*

P. J. WESTER.

During the early part of 1919 the writer first noted what to him was a new native legume, near Kawit, Zamboanga, and later a large patch of the same plant was found on the beach at the Patalon coconut plantation in the same province. Still later it was found in Basilan and in Dava and Cotabato. Herbarium specimens forwarded to Mr. E. D. Merrill, then botanist, Bureau of Science, were by him identified as *Vigna marina* Merr. According to Merrill it occurs throughout the tropics along the seashore. The plants noted were perennial, of vigorous growth and held their ground very well in competition with other native vegetation; on examination the vines were found to make roots quite freely, not only at the leaf axils, but on the stems between the leaves and the root system had a fairly large amount of nodules. Altogether the Silani appealed to the writer as a promising cover crop, and attention was called to its possibilities for this purpose in Bulletin No. 35, The Coconut Palm: Its Culture and Uses, 1920.

In 1919 seeds of the Silani were collected in Mindano and planted at the Lamao Experiment Station for further observation. It was found that the young seedlings were rather weak and required more care than ordinarily is given cover crops, such as the patani, *Phascolus lunatus* L., or the different species of *Tephrosia* and *Crotalaria*, but that once established they made a vigorous growth and made a good cover.

By way of description it may be stated that the silani is a perennial, trailing, twining, branching, and, when given support, a climbing vine, glabrous throughout. The leaves are trifoliate, with petioles from 8 to more than 15 cm. long. The leaflets are broadly ovate to oblong-ovate, acute or rounded, 5 to 8 cm. long. The flowers are yellow and grow on

* Silani is a contraction of a long native name of *Vigna marina* in a Mindanao dialect which has been adopted as a convenient common name for everyday use.

erect stems in the axils of the leaves. The pods are cylinder shaped, slender and slightly curved, 4 to 7 cm. long and contain 3 to 8 seeds about 5 mm. long.

The pods are produced sparingly and it is difficult to obtain seeds in quantity. This defect would preclude the employment of the silani as a cover crop were it not for the fact that the plant can be propagated from cuttings like its relative the kudzu, *Pueraria thunbergiana* and the kamote, *Ipomoea batatas* L., which was demonstrated at Lamao.

Inasmuch as it has been found that horses and cattle eat the silani cut as green forage, a sample thereof was submitted to the Bureau of Science for analysis, which was made by Mr. F. Agcaoili, chief, section of food analysis, division of organic chemistry, and is shown in the following table, together with analyses of alfalfa, cowpea, velvet bean, Guinea grass and Napier grass for comparison.

Table showing analyses of Silani and other green forage plants.

Constituents	Silani	Alfalfa	Cowpea	Velvet bean	Guinea grass	Napier grass
Water	65'77	75'17	85'70	82'18	77'85	61 81
Protein	3'17	5'38	2'07	4'81	3'37	2'92
Carbohydrates	24 35	8'43	4'36	4'99	8'09	17'29
Sugar	—	—	1'25	0'58	—	—
Fat	0'83	0'70	0'59	0'94	'57	'29
Fibre	4'04	7'82	4'70	5'06	7'30	14'77
Ash	1'84	2'50	1'33	1'44	2'85	2'92

The nutritive value of the forages included in the foregoing table are as follows: Silani, 29'3; alfalfa, 15'3; cowpea, 11; velvet bean, 12'5; Guinea grass, 13'8; Napier grass, 20'8.

While the Silani is seen to have a lower protein content than the alfalfa and velvet bean it is so exceptionally rich in carbohydrates that it has nearly twice the nutritive value of alfalfa and comes near being three times as nutritious as its relative, the cowpea. It is true of course that no digestibility tests have been made with the silani, but considering its chemical analysis there is but little doubt that it has a high actual food value.

Dr. Stanton Youngberg, chief veterinarian of this Bureau, commenting on the value of the silani as a forage plant says: "On account of its high carbohydrate content this forage should be of special value for 'finishing off' cattle before taking them off the range and placing them on the market. Hitherto there has been no suitable forage for this purpose in these Islands. If the digestibility of the silani is reasonably good there is no question but that this new forage will fill a distinct want and be a valuable addition to those we now have."

During the carnival in Manila in February, 1924, the writer met Mr. Fernando D. Luistro, in charge of a coconut plantation on the island of

Basilan, near Zamboanga, who stated that he had used the silani successfully as a cover crop for an area of about 20 hectares. Mr. Luistro stated that according to his experience the only objectionable feature of the plants was their climbing habit which necessitated frequent clearing of the vines from the young coconut trees.

The silani makes the best growth where the rainfall is of equal distribution throughout the year, but also made a good growth at Lamao during the rainy season, and during the following dry season with the aid of irrigation. Lacking rainfall, and without irrigation, the plants merely maintain themselves alive and make scarcely any growth, and it is questionable if this crop could be grown profitably where there is a prolonged dry season.

If the silani is of pantropic distribution there should be no difficulty in getting cultures thereof started throughout the tropics at least within reach of the coast.

As has previously been stated the silani is a sparse seeder and cuttings must be depended upon for planting the crop on a large scale. The planting should be done during the rainy season.

The cuttings should be made 40 to 50 centimeters long and should be well protected from drying out. Furrows should be opened about a meter apart and strong cuttings dropped therein about 30 centimeters apart which should be immediately covered by another furrow of soil so that the topmost leaf joint is about even with the surface of the ground. The last plough should be followed by a man with a hoe to adequately cover cuttings that have been insufficiently covered with soil, who then, as he passes on, should pack the soil firmly around the cuttings with his feet, for if the soil is not packed firmly around the cuttings many are apt to fail or to be slow in starting into growth. Once the plants are well established they make a rapid and vigorous growth and rapidly cover the ground and smother the weeds.

It is not known how long a cover crop of silani plants will persist after planting, but the writer has observed patches of wild plants maintaining a thick blanket for four years in full sun exposure. Being a strand plant, naturally adapted to a maximum of light, the silani probably would not maintain itself that long in a coconut or rubber plantation where the shade increases as the trees grow up.

The silani should undoubtedly be of value as a forage and cover crop plant in the moist districts of Hawaii and Porto Rico, but is unlikely to be of more than passing interest on the continental United States excepting possibly the southern part of Florida.

The hybridization of the perennial silani with its close annual relatives, the cowpea, *Vigna sinensis* Savi., and the sitao, *V. S. sesquipedalis* Fruw., should be of decided interest.—Sugar Central and Planters' News, Vol. V, No. 11.

PESTS AND DISEASES.

PRESENT NEEDS IN CANE DISEASE CONTROL.

H. ATHERTON LEE.

Pathologist, Hawaiian Sugar Planters' Association Experiment Station.*

An ounce of prevention is worth a thousand pounds of cure. This is the old Scotch epigram modified to fit the situation in regard to the curing of cane diseases, and it is not at all difficult to find instances to illustrate the truth of this old saying.

Take the case of mosaic disease: nearly all cane men know of the outbreak of this trouble in Porto Rico. There is considerable circumstantial evidence to indicate that mosaic disease has been well established in Oriental countries for years and that it is a trouble comparatively new to sugar countries of the Western Hemisphere. Mosaic disease was known in Java as early as 1890 and has existed in the Philippines for years; it was first noticed in Porto Rico in 1916. The disease is known to have spread to Egypt on cane cuttings imported from Java. Cuttings of cane from Java are also known to have been imported into the Argentine and it is known that cuttings with mosaic disease were introduced into Porto Rico and Cuba from the Argentine.

If we go back over this trail, therefore, it can be seen where mosaic disease could have been stopped inexpensively and easily. If the cane introduced into the Argentine had been carefully selected in Java, there would have been no mosaic disease in the Argentine. If the cane had been carefully selected in the Argentine before its introduction into Porto Rico, the trouble would have been prevented very economically in Porto Rico. Exclusion of mosaic disease would have saved Porto Rico from enormous expense, and expense which is being repeated year after year and probably will be repeated annually for some time to come. Exclusion of mosaic disease would have saved sugar yields for the Argentine and for Cuba and Louisiana, also, at practically no cost.

But there are other good illustrations of the way in which an ounce of prevention of cane diseases is worth many pounds of cure. Fiji disease, which is a comparatively new trouble in the Philippine Islands, is another good instance of how precautions to secure exclusion would have saved some of the growers considerable worry and added to their cane yields year after year. Fiji disease has been known in the Fiji Islands, Australia and New Guinea since the year 1910. In 1916 it was found in the Philippines and there is circumstantial evidence to indicate that it was introduced there on cane cuttings imported from Australia about the year 1912.

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There are many other examples: Downy mildew of sugar-cane is a disease carelessly imported into Formosa and later from Formosa into the Philippine Islands. A new trouble, known as red stripe, caused by bacteria, is an introduced disease in Hawaii; gum disease, also caused by bacteria, is an introduced trouble in Porto Rico; wilt, caused by a fungus, is an introduced disease in the Philippines.

There are two extreme views in regard to cane diseases. One class of cane men regards all cane diseases as devastating, calamitous troubles and the word "disease" to them brings up visions of blighted crops and bankruptcy. Another class looks upon all cane diseases as negligible troubles, similar in nature to leaf spots. There is a middle ground which regards cane diseases as having varying degrees of seriousness. Leaf spots, as a rule, are usually negligible except under extreme conditions favouring their development. On the other hand, there are more serious troubles, such as mosaic disease, Fiji disease, cane smut, downy mildew, and gum disease, which very materially lessen yields. Although entire destruction of a crop is a very rare thing, in some cases one or several of these diseases have been known to cause total failure in one or several fields. Whenever one of these troubles is at all common there is usually such a material reduction in yields as to form the difference between profit and loss, particularly in years of poor prices.

Probably the worst cane disease in the countries of the Western Hemisphere is mosaic disease. This is only one serious trouble, while in Oriental countries there are a number of diseases, any one of them often as serious as mosaic and sometimes more serious.

Fiji disease, for instance, is an infectious trouble, known to be transmitted by cane cuttings but the cause of which is unknown; it is now found in Fiji, Australia, New Guinea and the Philippines, and has not yet been introduced into cane countries of the Western Hemisphere, nor has it reached Java, India, Mauritius, Natal or Egypt as yet. This disease can be prevented with no cost at the present time in Hawaii, Cuba, Porto Rico, Louisiana, the Argentine, Mauritius, India, Egypt, and Java by entire exclusion. In other words, now is the time to exercise the ounce of prevention for Fiji disease. No canes should be imported into these countries from Australia, the Philippines, or Fiji except after personal inspection by a competent authority on cane, cane diseases and cane insects. Even after such selection the new cane varieties, when imported, should be kept in isolation for the plant crop and one ratoon crop. Distribution of cuttings of the new imported variety should not be made until the first ratoon crop has been harvested. We know of no cane varieties, as yet, with any high degree of resistance to this trouble. H 109, the Cheribon canes, Yellow Caledonia, Uba and all commonly grown varieties are susceptible.

Downy mildew is another trouble, caused by a fungus, and known to be transmitted by cane cuttings; it is only found in Formosa, the Philippines and Australia and has not reached the Western Hemisphere and is still unknown in Java, India, Mauritius, Natal and Egypt. In the Philippines, Uba cane is especially susceptible to downy mildew.

Cane smut, caused by a fungus, is known to be transmitted by cane cuttings; it is reported from India, Natal, Java, Italy, Mauritius, the

Philippines and Australia, and two points in the Western Hemisphere, Trinidad and British Guiana. In the Philippines, Uba cane is also especially susceptible to cane smut.

Sereh is a trouble, the cause of which is unknown, but it is well established that it is transmitted by cuttings. It is authentically known only in Java as yet, although there are reports that it is also in Formosa. It is not known as yet in any of the other cane countries. It is probably only good fortune that it has not been introducted into the Argentine since cuttings were imported there direct from Java.

Gum disease, caused by a bacterial organism, was first known authentically from Brazil and later, in the year 1893, from Australia. It is also known in New Guinea, Mauritius, Reunion, and Porto Rico. What is considered a similar trouble is known in Java, Borneo and the Philippines. It is transmitted by cane cuttings. Gum disease is not known as yet in Hawaii, Formosa, India, Egypt, Natal, Louisiana nor Cuba. A new trouble is being reported from Australia, known as leaf scald, caused by a bacterial organism. It is not known in other countries, nor is red stripe disease, a new bacterial disease in Hawaii.

These are the more serious troubles, the most of which have not yet become established in the cane countries of the Western Hemisphere. The absence of these diseases is a considerable advantage to western countries in competition with oriental lands where labour is so much cheaper. This advantage may be maintained by the exclusion of these cane diseases. What is needed in cane countries of the Western Hemisphere is a considerable campaign of publicity concerning these well established and destructive cane diseases in the Orient. Every cane man should know of the existence of these diseases in other countries, and having such knowledge, should insist that no cane importations be made except by competent cane men working in close contact with men versed in cane diseases and cane insects. It is a sad fact to contemplate, but in the illustrations of the importance of cane diseases which have just been related, in four instances Government experiment stations and rather well known cane men are implicated as having brought about the introduction and distribution of these diseases; inadvertently and innocently, it is true, but neverthless the harm has been done.

To summarize: an ounce of prevention against cane diseases is worth many pounds of cure. Now is the time for cane sugar producers in the countries of the Western Hemisphere to exercise the ounce of prevention against Fiji disease, downy mildew, sereh, cane smut, gum disease, leaf scald and possibly other unknown troubles and numerous insect pests.

If new cane importations are to be made, and progress in cane production necessitates such importations, selection of the cane cuttings to be imported should be made by a competent authority. The imported cuttings should be grown in isolation under Government supervision for at least one plant crop and one ratoon crop. During this period of quarantine, inspection should be made several times each month by cane men working in close Co-operation with cane entomologists and cane patholgists.—The International Sugar Journal, Vol. XXVI, No. 310.

THE CAUSE OF MOSAIC DISEASE OF SUGAR-CANE.

A STEP TOWARD THE SOLUTION OF THIS MYSTERY.

ARTHUR H. ROSENFELD,

Special Technologist for Cane, Insular Experiment Station, Porto Rico.

The term "germ" is very broad in its significance and is frequently employed as indicating practically any sort of organism causing infection or disease in animals or plants. It is, nevertheless, a far call from the bacteria, or minute vegetable organisms which reproduce themselves by fission, which are the cause of such human diseases as cholera, typhoid fever, leprosy or charbon, to the filamentous *moulds*, which are responsible for so many skin diseases in man as well as the domestic animals, or to certani forms of *yeasts*, which cause diseases amongst animals. In the Tropics the majority of the most dreaded diseases of human beings, such as malaria and sleeping sickness, are caused by the introduction into the system of a small animal organism composed of a single cell, and recent scientific investigations have tended to indicate that a considerable number of the diseases of cultivated plants may be due to this same class of "germ."

There are a number of diseases, human as well as plant, of which the causative organism is still not definitely determined, notwithstanding the fact that some of our most prominent bacteriologists and mycologists have dedicated entire decades to searching for them. Amongst the plants the group of diseases known as "Mosaics" from the form of the discolorations in the leaves of the affected plants, has received much attention and investigation without any definite isolation of the causative organisms being yet accomplished. To this class of disease belongs that affliction of sugar-cane which has been the cause of so much havoc in various sugar-producing countries—Sugar Cane Mosaic.

It is evident that this disease is caused by an organism, since it may be transmitted from infected to sound plants, as has been demonstrated by Brandes in Cuba, Kunkel in Hawaii, Chardon and Veve in Porto Rico and others. In recent years the concensus of opinion amongst the workers with this disease has tended to place the causative organism in that class of minute bodies generally denominated as *ultravisible* or *filtrable virus*. The term *filtrable* indicates that the virus or serum is so fine that it can be forced through the pores of the best cooked porcelain—pores so small that they can hardly be distinguished with the most powerful microscope—and yet retain their virulence, although this class of filtration will eliminate all organisms commonly visible under the microscope.

The well-known "Foot and Mouth Disease" of bovine animals also belongs to this class of diseases which is supposed to be caused by a *filtrable virus*, and it is with the organism causing this particular disease of perhaps the most important amongst domestic animals that discoveries have recently been made in Germany by the bacteriologists Doctor Paul Frosch and his colleague Prof. Dahmen which may throw considerable light in the path of future investigation of the causal agent of sugar-cane mosaic. Franz Schikora, associated with the two eminent bacteriologists above-mentioned in this piece of scientific research which may be epoch-making in its

consequences, has written for the *Vossiche Zeitung** under the striking title of "Our Most Minute Enemies Unmasked" a fascinating account of this discovery which admirably demonstrates not only the importance of the work of Doctors Frosch and Dahmen, but also the complete interdependence of the various branches of modern science.

In speaking of the invasion by the German bacteriologists of what he aptly calls "the hypothetical field of unknown vegetable life" and the annexation of this territory to the field of recognized bacteriology, Schikora says :—

"Dr. Frosch reasoned that the invisibility of these disease producers is the result of their extremely small size which inhibits our seeing them even with the most powerful of microscopes. It may be that the layman does not realize that even the microscope has its limitations. If an object be so small that it deflects or interrupts only a few rays of light of distinct lengths, which rays combine to form white light, the image which reaches the retina of the microscope observer is absolutely undefined ; or if the object is sufficiently small no image whatsoever is produced. Such objects are really invisible even to the best aided human eye. It was necessary to find some way of making them visible.

"It is the essence of scientific genius to be able to utilize a method developed in some other branch of science for solving a problem along the line of one's own particular speciality. To this inspiration we have to give thanks for many of our discoveries."

Dr. Frosch followed this procedure in utilizing a very original and ingenious microphotographic apparatus designed by Prof. Kohler of Jena, who had originated it with the idea of employing the ultraviolet rays, invisible to human sight, for increasing the clearness and definition of certain visible objects. The greatest contribution of Dr. Frosch, according to Schikora, was "the utilizing of this same apparatus and this same method in obtaining images of objects which were before invisible."

The first disease attacked by Dr. Frosch was bovine pneumonia, the causative "germ" of which had already been propagated by him and Prof. Loffler some time before, but the organism of which they had not yet been able actually to see, since it manifested itself in a sort of white cloud which up to that time they had not been able to resolve into its component parts. After long and patient experimentation Dr. Frosch succeeded in obtaining with the above-mentioned apparatus photographs of these organisms which proved to be inconceivably minute fungous structure.

Successful in this attempt, Dr. Frosch turned his attention to the "foot and mouth disease," the causative organism of which had never yet been cultivated in dry culture—something absolutely indispensable for Dr. Frosch's purposes. "Here," Schikora tells us

"Dr. Dahmen comes upon the scene. This expert bacteriologist devoted himself to discovering not only an appropriate culture medium, but also some method of propagation which would render it feasible to grow the organism outside of the body and without moisture. Only a specialist can

* Berlin, 27th May, 1924.

appreciate the difficulties here presented. Fortunately Dr. Dahmen not only settled this problem satisfactorily, but also made discoveries which will aid us materially in combating the pest."

In order not to enter into details of too complex a nature, it is sufficient to say that, as the result of long and patient endeavour, the enthusiatic scientists finally succeeded in obtaining microphotographs revealing the bodies causing "foot and mouth disease." It is a bacillus of a maximum length of not more than one ten-thousandth of a millimetre—about one quarter millionth of an inch! Schikora concludes:—

"The course to follow in future investigations has been plainly set. One of the great victories on the field of medical exploration has been won. Besides the term "ultravisible virus" now passes out of fashion."

It appears that, with the author of this interesting and suggestive article, we may have confidence, now that the black continent of unknown bacteriology has twice been crossed, that other of her secrets will be revealed to the man of science, and we hope that amongst these and perhaps at no far distant date we shall learn more of the mysterious secret of the organic cause of sugar-cane mosaic disease.—The International Sugar Journal, Vol. XXVI, No. 310.

A SERIOUS PEST OF CARDAMOMS.

K. KUNHI KANNAN M.A., Ph.D., F.E.S.

Entomologist to the Government of Mysore.

Year after year for the past four or five years swarms of caterpillars have appeared on cardamom in Sakleshpur, Mudigere and neighbouring taluks, causing heavy loss to the growers. They were not noticed during the hot weather, but after the rains they were first seen in small numbers which, later during the cold weather, swelled into many millions. They start apparently in the forest, multiply there and defoliate practically every tree in the locality and when there is nothing more left to feed on, descend by long threads on to the cardamom and strip the leaves to the midribs. They do not appear to feed in the day-time when most of them may be found congregating in masses on the trunk of the trees, in the hollows of decayed logs or in other shelters to be found elsewhere. As soon as it darkens—sometimes a couple of hours earlier—they scatter, work their way back to the crop and feed on it all night.

The caterpillars are all of them wooly and more or less slaty or dark blue in colour with lac-red heads, stripped or mottled yellow. The body markings vary but usually there are lateral stripes with dark blotches on the back. These are, however, obscured by the numerous hairs, grey, or dark blue. These hairs are easily detached when touched and are poisonous causing irritation of the skin but nothing more serious. It is these hairs that give to the collections of worms the appearance of a blanket.

The caterpillars when full grown spin a thin dirt-coloured cocoon and turn into shining black inside. The moths emerge out of these. Very few have been successfully reared out. It is not possible, therefore, to determine their correct identity. Possibly they are *Euproctis minor* that appeared in similar swarms in Burma several decades ago. At any rate the habits are similar.

The havoc caused is extremely severe and since it has appeared several years in succession something has to be done to control the pest. The start that it has in forest areas makes it difficult to locate it in the initial stages when control should be easy. The only resource left until more information can be obtained is to deal with it when it appears on the cardamom crop or in the immediate neighbourhood. Since the caterpillars remain together in masses in the day-time it should not be difficult to deal with them there. They could be burnt off with torches but there are obvious objections to the use of torches in estates with plenty of dry leaves and logs about. Two other methods were tried—one by spraying the colonies with kerosene and strong kerosene emulsion. A small tin syringe provided with a fine rose which can be made at a cost of eight annas would do or a hand syringe of brass strongly made could be obtained at a cost of about Rs. 7. The operation is easy and enormous numbers can be killed off easily. The other method is to dust the caterpillars with cyanide powder mixed with cyanide dust, chalk powder or any other fine carrier The powder will lodge easily amidst the numerous hairs and the gas evolving would kill off caterpillars quickly. Both these methods have been tried and found effective but there are some difficulties. Not all caterpillars leave the cardamom to congregate in the situations described. Some remain in the under-side of the leaves where kerosening is out of the question, and dusting would be tedious without a duster but the number of such caterpillars is small and injury they may do may not be serious if caterpillars elsewhere have been accounted for. The more serious difficulty is that the invasion is sometimes in such countless hordes that even if all the masses in accessible situations have been killed off, there may be still many millions left on the trees above which may descend and complete the havoc. Spraying the cardamom with a stomach poison will avail little, for a whole crop so sprayed may poison but a fraction of the caterpillars. A repellant which when sprayed would keep them off the crop would be all right. But several were tried and found useless. There is some hope of one proving useful, but further tests have to be made to prove its worth. Even if it is found satisfactory it is not many owners who can find the labour to distribute it over the plants. It is likely, furthermore, that rains may not allow it to retain its property long. It seems, therefore, almost impossible in the present state of our knowledge of the pest to do anything useful if the caterpillars invade in many millions. But if they are in less formidable dimensions, as fortunately they are usually, the simple remedies described above of kerosening or dusting would suffice. For a few days when the damage threatened appears imminent the watchman usually stationed to look after the crop should be instructed to deal with the masses of caterpillars in the way described. Those that are found to remain on the cardamom may be dusted with cyanide or may be disturbed off when they also will try to congregate in situations where they can be more easily dealt with. It is possible also that thinning out the shade above the crop may make the shelter of cardamom leaves unattractive to the caterpillars by the greater heat and light which it would let in. This, however has yet to be tested.

The Department is continuing its investigations of the pest and further trials with repellants and other remedies will be made as soon as opportunity offers. In the meanwhile, it would urge on such of the members of the Union as own cardamom to test the remedies described and report results to the Department. A limited quantity of cyanide and carrier will be distributed free to them on request with full instructions as to how it should be used —The Journal of the Mysore Agricultural and Experimental Union, Vol. VI. Nos. 2 and 3.

IMPORT OF PLANTS INTO THE DUTCH EAST INDIES.

TRANSLATED FROM THE DUTCH BY H. L. LUDOWYK,
Librarian, Department of Agriculture.

The following regulations have been published regarding the importation of plants into the Dutch East Indies :—

1. CERTIFICATE FROM THE COUNTRY OF ORIGIN.

All consignments of living plants or living parts of plants (seeds included) from foreign countries (including Holland) to the Dutch East Indies—with the exception of the seeds and plants named below—must be accompanied by a certificate from the country of origin, stating the species to which the plant material belongs, the quantity, and a declaration by a Government expert that the consignment is free from diseases and pests.

In the case of postal parcels the certificate should be attached to the Customs declaration; in the case of letters and samples of no value, the certificate should be included in the envelope with the letter of sample: in the case of cargo, it should be sent to the importer, who must present it, on clearing the goods, to the Customs officer who is responsible for the examination.

2. PLACE OF EXAMINATION.

Since the examination of plants (including bulbs, tubers, cuttings and seeds) is not now carried out at Buitenzorg, but at Tandjong-Priok and Medan (Belawan Deli), the consignors of plants and seeds are requested not to address them to the Institute for Plant Diseases, but, in the usual way, to the consignee. It is, however, necessary to furnish all parcels which are subject to examination with the addition "*Via Medan (Plant Material)*" in case they are destined for Deli, and with the addition, "*Via Tandjong-Priok (Plant Material)*" in case they are destined for any other part of the Archipelago. The address labels of parcels should also be provided with these additions.

In the case of cargo, the contents of which are subject to examination, a request should be made to the Steamship Company to add this to the bill of lading for Deli if the goods are destined for Deli, and to the bill of lading for Tandjong-Priok if it is destined for any other part of the Archipelago, so that it may be unloaded either at Medan or at Tandjong-Priok for examination. The examination of plants, etc. conveyed as luggage is done only at Belawan Deli and at Tandjong-Priok: at Belawan Deli the examination of plants and seeds brought by passengers who disembark there, and at Tandjong-Priok the examination of the plants of all other passengers. Passengers who do not definitely disembark at Tandjong-Priok are particularly informed that they should allow their plants to be examined at *Tandjong-Priok*; at *Semarang*, *Soerabaja* or other ports there are no facilities for this.

The examination of fresh fruit intended for consumption takes place at *Medan*, *Tandjong-Priok*, *Semarang*, *Soerabaja* and *Makassar*, and provisionally at Padang.

3. EXEMPTION FROM EXAMINATION

The following plants and seeds are exempted from certificate and examination:

(*a*) *Seeds* of the following species of vegetables and fruits: endive, asparagus, gherkin, brinjal, beet (including mangel-wurzel), turnip and rape, cucumber, cabbage species, lettuce, melon, parsley, Chinese cabbage (also called pak-choi), pumpkin, purslane, leek, radish, rhubarb, scorzonera, celery, spinach, tomato, nasturtium, onion, water-melon, chicory, carrot sorrel.

(*b*) *Seeds* of the species of plants belonging to the following families of ornamental plants: acroclinium (everlasting), amaranthus, antirrhinum (snapdragon), aster, begonia, celosia, centaurea (blue-bottle or corn-flower), chrysanthemum (ox-eye, dog-daisy, etc.), coleus, coreopsis, cosmos (or cosmea), delphinium (larkspur), dianthus (carnation), gaillardia, gerbera, helianthus (sunflower, etc.), impatiens (balsam), lathyrus (sweet peas) myosotis (forget-me-not), papaver (poppy), pentstemon, petunia, phlox rudbeckia, salvia (sage), tagetes (African marigold), viola (heartsease, pansy) verbena, zinnia;

(*c*) *Plants, cuttings, bulbs, tubers, seeds*, etc. that are addressed to the Department of Agriculture or to the Institute for Plant Diseases.

(*d*) all *seeds* that are intended for direct consumption, such as split peas, brown beans, almonds, chestnuts, walnuts, lotus nuts.

(*e*) the following *species of vegetables* provided they are intended for direct consumption: endive, beet, garlic, cabbage, lettuce, potatos, carrot, Chinese cabbage (also called pak choi), purslane, leek, spinach, tekie (*Cyperus tuberosus*), nasturtium, onions, sorrel;

(*f*) fruits of the coconut palm, with the husk removed. All the seeds and plants named above under (a), (b), (c), (d), (e) and (f) can thus be sent by a dealer in the Netherlands (or any other country) without any formality. The dealer, however, should see to it that, for the guidance of the postal service and the Customs the name of the species of seed which the letter, etc., contains is clearly stated on the letter, the sample, the Customs declaration of the parcel, or the bill of lading.

Dealers are notified to send separately:

a. seeds that are exempted from certificate and examination, and

b. seeds, cuttings, tubers, bulbs and rooted plants which must be accompanied by a certificate and are subject to examination.

4. IMPORT OF *HEVEA* PLANTS.

The import of *Hevea* plants or parts of *Hevea* plants (including *Hevea* seed) from South America is wholly and strictly prohibited.

5. IMPORT OF TEA SEED.

On the import of tea seed there exists a control which has been exercised for some years by the Adviser for Tea Cultivation.

6. INFORMATION.

All correspondence regarding the import of plants and seeds should be addressed direct to the Director of the Institute for Plant Diseases, Buitenzorg, who will gladly supply any information desired.

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AGRICULTURAL EDUCATION.

INSTITUTE OF PLANT INDUSTRY, INDORE.

A new Research Institute for the improvement of crops, at which special attention will be paid to cotton and to the fundamental problems underlying the production of this crop in India, was formally inaugurated at Indore in Central India on November 24th, 1924. The foundation of this new Institute has been rendered possible by the provision of a valuable site of 300 acres by the Indore Durbar, by a grant of two lakhs of rupees (about £15,000) for capital expenditure by the Indian Central Cotton Committee, and by an annual contribution of 120,800 rupees a year (a little more than £9,000) for current expenses in addition to the income derived from the land at the disposal of the Institute. This annual grant has been provided jointly by the Indian Central Cotton Committee and by seven of the Central India States (Indore, Dhar, Jaora, Datia, Rutlam, Dewas Senior Branch, Narsingharh and Sitamau.)

The control of the Institute has been vested in a Governing Body of six members with the Agent to the Governor-General in Central India as President. Three members of the Board of Governors are nominated by the Indian Central Cotton Committee, one by Indore Durbar and two by the rest of the contributing States. The Director of the Institute will act as Agricultural Adviser to the States and will in this way come in direct touch with the Malwa plateau, one of the most important cotton tracts in India.

The experimental area, which has been leased by the Indore Durbar to the Institute for 99 years at a nominal rent of £20 a year, embraces all the types of black cotton soil met with in India and is very favourably situated for research work on crops. It is close to the city of Indore, now rapidly growing in importance as a commercial, manufacturing and educational centre, and to the cotton mills.

The maintenance of an up-to-date library on crop-production and the training of post-graduate students, selected by the Indian Central Cotton Committee, will be features of the Institute. Mr. Albert Howard, C.I.E. (formerly Imperial Economic Botanist at the Agricultural Research Institute, Pusa) has been appointed Director of the Institute and Agricultural Adviser to States in Central India and Mrs. Howard (formerly Second Imperial Economic Botanist at Pusa) will be employed as Physiological Botanist at Indore.

CEYLON AGRICULTURE.

ESTATE PRODUCTS COMMITTEE.

Minutes of the Twenty-second meeting of the Estates Products Committee of the Board of Agriculture held at the School of Tropical Agriculture, Peradeniya, at 2-30 p.m., on Thursday, November 13th, 1924.

Present :—The Acting Director of Agriculture (Chairman), the Acting Government Botanist and Mycologist, The Government Entomologist, The Acting Government Agricultural Chemist, Messrs. L. A. Wright, H. D Garrick, J. B. Coles, E. W Keith, N. G. Campbell, E. M. Windus, E. Maberley Byrde, Gate Mudaliyar A. E. Rajapakse, Messrs. J. Horsfall, J. W. Oldfield, T. A. de Mel, Wace de Niese, J. S. Patterson, R. G. Coombe, A. T. Sydney Smith, A. F. B. Smeaton, A. Coombe, R. P. Gorton, C. C. du Pre Moore, Graham Pandittasekera, J. W. Scott, M. H. Reeves, and H. A. Deutrom (Acting Secretary.)

As Visitors :—Messrs. Chas. Gibbon, J. Fergusson, and A. W. R. Joachim.

Letters and telegrams regretting inability to attend were received from the Hon. the Colonial Secretary, the Hon. the Controller of Revenue, Dr. W. P. Rodrigo. Messrs. D. S. Cameron, C. C. Durrant, H. L. De Mel, G. W. Hunter-Blair, N. D. S. Silva, and H. P. Daniell.

Before proceeding to the business on the Agenda the Chairman referred to the death of Mr. M. Kelway Bamber who had been a member of this Committee from its inception. Mr. Bamber was identified with Ceylon Agriculture for more than 25 years and a great measure of the progress which it had made in that time was due to his ability and enthusiasm. A vote of condolence and sincere sympathy with his widow and family was passed, all standing.

The minutes of the previous meeting, which had been circulated to members, were confirmed.

Agenda Item 1. Progress Report, Experiment Station, Peradeniya.

The Chairman commented on a few items of interest in the report.

Mr. Horsfall enquired whether there was any seed of Indigofera endecaphylla available.

The Secretary replied that seed would not be available till about next March but a limited number of cuttings could be supplied to applicants for trial.

Agenda Item 2.—Soil Erosion.

The Chairman stated that the Sub-Committee appointed to consider the question of soil erosion had submitted its report to Government and its recommendations had gone before the Committee, appointed to consider the amendments of the Forest Ordinance. The Estates Products Committee had taken a very broad view of the question of soil erosion, but the

Committee appointed to consider the amendment of the Forest Ordinance were of opinion that the main point of the subject was the prevention of the surface wash from estates and cultivated lands generally. All, however, were in agreement that further experiments should be carried out by the Department of Agriculture to determine methods of checking soil erosion. These experiments would have to be carried out in up-country districts, and, in the absence of a tea research station, they could only be done in co-operation with planters on up-country estates. This would entail trials with different cover plants in different districts. Cover plants were available for the low country, but owing to greatly varying conditions up-country no definite cover crop could yet be suggested. Special experiments would have to be conducted before the most suitable cover crops for the different districts could be recommended. At present, efforts were being directed to securing as many up-country specimens of leguminous plants as possible, the idea being to grow them in contour belts through the tea on some up-country estates. The Chairman then enumerated the most likely cover plants for the various districts.

He then brought forward another aspect of soil erosion in the gradual widening of drains into ravines, which occurred on some up-country estates. A suitable plant would have to be found to protect these ravines from further erosion. The method adopted in Java was to grow grass on the sides of drains to prevent them from falling in.

In conclusion, the Chairman said Government viewed the question of soil erosion most seriously, although they did not agree with all the proposals of the Committee. The general opinion was that the report confused water conservation with soil erosion and that it rested with the Estates themselves to stop the surface wash of cultivated soil.

Mr. Horsfall said that he had Indigofera endecaphylla growing extremely well at 4,500 ft. It was put in only last April with seed from South India and was now a solid mat, 2 ft. wide and 18 inches high.

Mr. Sydney Smith enquired why the Chairman particularly emphasised that these cover crops should be grown in belts.

The Chairman replied that it was necessary to make a continuous line across a hill-side. If there was a gap in the belt the soil would wash through and that was the argument against plants that grew straight up instead of growing flat. If the belts were continuous, the soil in time would tend to form terraces.

Mr. L. A. Wright enquired whether Oxalis had an exhausting effect on the soil. The Chairman replied that there were no data on that point. It was now being allowed to grow in some cases to stop wash and no doubt we should know in a few years whether it was detrimental or not.

Mr. Wright stated he knew of many estates which were covered with oxalis but their yields had not dropped.

The Chairman stated that it was not desirable to recommend a cover crop which could not be eradicated if necessary.

A discussion followed on the method of planting in contour lines.

Mr. Allen Coombe enquired whether there were any records of the amount of soil wash under modern planting conditions. He thought that silt pits in use at the present day ought to prevent much loss of soil.

The Chairman replied that any comparison between old and modern methods was only possible by conducting both methods on the same hillside with properly cemented pits to measure the exact amount of wash.

The Chairman said that although they had not arrived at any definite conclusion, he would recommend planters to put into practice immediately the method obtaining in Java of protecting their ravines by growing grass along the sides.

Agenda Item 3—Report on samples of cacao sent to Messrs. Cadbury Bros. Ltd.

Samples of cacao, prepared in six different ways, had been submitted to Messrs. Cadbury Bros. Ltd., and the report received had been circulated to members. With regard to the reference in the report to a mixture of varieties the Chairman stated that the Cacao on the Experiment station, Gannoruwa, where these experiments were conducted, is almost entirely Forastero.

Dr. Lock, in 1904, found that in the Gannoruwa Forastero 63 per cent. of the seeds were purple and 37 per cent. white. The figures given in the report as the percentages of Forastero and Criollo in these samples totalled to 381 of the former and 219 of the latter, or a percentage of 63·5 of Forastero and 36·5 of Criollo. There was consequently little doubt that the samples were not mixed, but were ordinary Ceylon Estate Forastero, which contains purple beans and white beans in the same pod.

Mr. E. W. Keith proposed a vote of thanks to Mr. Knapp, the Chemist of Messrs. Cadbury Bros. Ltd., for the trouble he had taken in preparing the report. This was carried unanimously and the Chairman undertook to convey the thanks of the Committee to Mr. Knapp.

The Chairman said the remainder of the experiments would be held over until Mr. F. A. Stockdale had conferred with Mr. T. H. Holland and Mr. A. W. Knapp in London.

Item 4—How much money will be available in the current year for Tortrix investigation and how much has been spent during the last year.

The Chairman, in reply to the above question standing in Mr. L. A. Wright's name, said there was no allocation specially for Tortrix only, the vote for the Entomological division being a general one. It was not split up unless there is an officer specially appointed to investigate a particular pest. The previous Tortrix investigation cost Rs. 15,500.

Mr. Wright enquired how they were to proceed if any district wanted any information. The Chairman replied that either the Entomologist or his Assistant would visit the district.

Item 5—Samples of made tea from Buitenzorg, Java.

The Chairman handed round samples of made tea received from Buitenzorg, Java, which were examined by the members.

Item 6—Relation of tea soils to quality.

On this subject Mr. Bruce briefly explained the main differences between high and low elevation soils in different districts. He stated that one could not look to the soils for an explanation of quality.

H. A. DEUTROM,
Actg. Secretary,
Estates Products Committee.

DISTRICT AGRICULTURAL COMMITTEE, MATARA.

Proceedings of the 2nd Meeting of the District Agricultural Committee held on 21st November at the Matara Kachcheri at 10 a.m.

Present:—Mr. G. S. Wodeman, Asst. Govt. Agent, in the chair, and the following members:—Messrs. F. Burnett, Divisional Agricultural Officer, A. T. Reeve, Plant Pest Inspector, E. J. Buultjens, G. Altendorff, W. H. Schokman, D. Samaraweera, Mudaliyars W. A. Amarasekera, S. W. Illangakoon, H. E. Wickramaratne, W. A. Perera and W. A. Wijesinghe. Letters from Mr. C. B. Collisson, Mr. Kannangara and Mr. J. E. Wijesinghe, regretting their inability to be present at the meeting were read.

The minutes of meeting held on 26th August, 1924, were read and confirmed.

It was resolved that the Chairman shall have a casting vote as well as an original vote.

Agricultural Competitions.—The Divisional Agricultural Officer read out the results of transplanting and garden competitions of the Division for 1924, and remarked that the transplanting results were very appreciable, the yields amounting in some cases to over 100 fold, while the Garden Competitions in Wellaboda Pattu were remarkably good.

It was resolved that transplanting and vegetable competitions for 1925 be restricted to members of the Co-operative Societies, and that paddy transplanting competitions be held for the ensuing Yala in Four Gravets, Gangaboda Pattu and Wellaboda Pattu and Garden Competitions in Weligam Korale, Morowak Korale and Kandaboda Pattu.

It was further resolved that the existing conditions be observed, except in the case of transplanting competitions, in which the minimum area entering for competitions should be half an acre.

It was decided that intending competitors should give their names to the Secretaries of Societies on or before 30th June, 1925. Judging will take place between July and August. In case of unseasonable weather the judging will be deferred.

It was also decided that the following points be observed in judging:—

TRANSPLANTING.

1.	Yield	20 Marks
2.	Cultivation	15 ,,
3.	Manuring	15 ,,
4.	Selection of seed ...	15 ,,
5.	Freedom of weeds and paddy fly	15 ,,
6.	Levelling	10 ,,
7.	State of bunds and attention to irrigation and drainage ...	10 ,,
	Total	100 marks.

VEGETABLE PLOTS.

1.	Vegetables grown, varieties ...	50 Marks
2.	General arrangement of garden	10 ,,
3.	Cleanliness and draining ..	10 ,,
4.	System of rotation and manuring	10 ,,
5.	Tilth of soil	10 ,,
6.	Evidence of marked originality	10 ,,
	Total	100 marks

Selection of Seed Paddy.—Resolved that a start be made for selection of seed paddy from the crops of the ensuing Yala competition plots, and that the competitors of each division should produce a sheaf of not less than 20 lb. in weight for judging purposes at a place to be appointed by the Mudaliyar of the Division.

Apportionment of Grants and Prizes.— Resolved that the Government Grant of Rs. 360/- apportioned for prizes be supplemented by a contribution of Rs. 240/- from the Huwandiram Funds and the donations of Rs. 15/- promised by Mudaliyar H E. Wickramaratne and the Chairman, and that the amount be divided as follows :—

(a) Transplanting in three divisions and Garden Competitions in three divisions, Rs. 95/- for prizes for each of the six divisions to be divided in 3 prizes of Rs. 50/-, Rs. 30/- and Rs. 15/-.

(b) *Seed Paddy.*—Rs. 20/- for prizes for each of the three divisions, *viz.*, Four Gravets, Wellaboda Pattu and Gangaboda Pattu competing for best sheaf of 20 lb.

Certificates.—Resolved that the Secretaries of the Co-operative Credit Societies who take a keen interest in securing competitors be given certificates instead of monetary rewards of Rs. 5/- each.

Representative to the Board of Agriculture.—Resolved, *nem-con.*, that the Hony. Secretary Mudaliyar W. A Amarasekera, the present representative, be re-nominated.

Agricultural Experiments.—The Divisional Agricultural Officer explained that as no reliable statistics of citronella cultivation are available in respect of cost of cultivation, upkeep, cost of manufacture of oil, etc., per acre an experimental garden had been opened at Borale in Weligam Korale to ascertain these particulars. The following varieties were cultivated on the plot.

	Variety			Extent		
				A.	R.	P.
1.	Heen batu pengiri	—	...	2	0	0
2.	Mana	,,	(Peradeniya)	-	2	0
3.	Maha	,,	(Java) ...	1	0	0
4.	Maha	,,	(Peradeniya) ...	-	2	0
5.	Maha	,,	(Local) ...	1	0	0

The meeting was unanimously of opinion that the undertaking was very useful and suggested that the soil of each plot should be analysed now, and that analyses should be made annually to see to what extent the soil had been impoverished.

Reports to Press.—Resolved that no member should communicate any account of proceedings of meetings to the press, the representatives of newspapers being at liberty to obtain a copy of the official minutes of the proceedings from the Hony. Secretary.

Irrigation.—The motions of Mr Wijesinghe regarding the deepening of Makawita Tank and erection of an embankment from Bandattara and Diyagaha were deferred owing to the absence of the mover. The Asst. Govt. Agent, however, said that he would look into the former, and that the latter proposal could be considered only in connection with the General Flood Protection scheme for the Nilwala Ganga Valley, which needed comprehensive preliminary investigation by an expert.

AGRICULTURAL COMPETITIONS IN GALLE DISTRICT.

The following prizes will be offered for competitions among the members of Co-operative Societies in the following four groups :—

1. Akmimana, Talpe, Illuppitiya and Heenetigala
2. Elpitiya, Batapola, Bentota, Kosgoda and Hikkaduwa
3. Ganegama, Gangaboda Pattu, Akuratiya and Telikada
4. Udugama, Nagoda, Hiniduma, Yatilamatta and Unanwitiya

MAHA SEASON 1924-1925.
For the best Miscellaneous Garden.

First Prize	... ...	Rs. 25-00
Second Prize	... ...	,, 15-00
Third Prize	... ...	,, 5-00

YALA SEASON 1925.
For the Best Plot of Paddy.

First Prize	... ...	Rs. 30-00
Second Prize	... ...	,, 20-00

Secretary's Prize.

A prize of Rs. 5 will be given to the Secretary obtaining the largest number of entries for both the competitions.

The Competitions will be subject to the following conditions:—

1. The extent of the land entered for the best plot of paddy competition must not be less than one acre; for the vegetable garden competition not less than $\frac{1}{4}$ of an acre.

2. Entries for the competitions will be restricted to the members of Co-operative Societies.

3. Competitors for the Maha Season Garden Competition must send their names to the Secretary on or before the 31st January, 1925. Competitors for the Yala Season Paddy Competition must send their names to the Secretary on or before the 31st May, 1925.

4. The Secretary of each Society will then send the list of entries to the Divisional Agricultural Officer, Southern Division, Galle.

5. The following is a list of points on which the plots will be judged :—

Miscellaneous plot.—Vegetables grown, varieties		50
	General arrangement of the garden	10
	Cleanliness and draining ...	10
	System of rotation and manuring	10
	Tilth of the soil	10
	Evidence of marked originality ...	10
		100
Paddy plot.—	Yield	20
	Cultivation	15
	Manuring	15
	Selection of Seed	15
	Freedom of weeds and paddy fly ...	15
	Levelling	10
	State of bunds and attention to irrigation and drainage	10
		100

6. The final judging will be carried out by officers of the Agricultural Department.

7. The results with distribution of prizes will be made at a special meeting of the Societies to be convened later.

F. BURNETT,
Divisional Agricultural Officer,

AGRICULTURAL COMPETITIONS IN HAMBANTOTA DISTRICT.

The following competitions will take place in the Hambantota District during 1924—1925.

The Gold Medals are being given by Mr. E. S. Captain of the Ceylon Spinning and Weaving Co., Ltd., to encourage cotton growing.

EAST GIRUWA PATTU.

Cotton Competition.

For the best three plots of cotton grown in :—

Paranagampalata.

First Prize	...	Gold Medal and Rs.	20·00
Second Prize	...	,, ,,	15·00
Third Prize	...	,, ,,	5·00

Wewgampalata and Pahalawalakada.

First Prize	...	Gold Medal and Rs.	20·00
Second Prize	...	,, ,,	15·00
Third Prize	...	,, ,,	5·00

Ihalawalakada and Modaragampalata.

First Prize	...	Gold Medal and Rs.	20·00
Second Prize	...	,, ,,	15·00
Third- Prize	...	,, ,,	5·00

MAGAM PATTU.

For the best three plots of cotton grown in :—

Magam Pattu.

First Prize	...	Gold Medal and Rs.	20·00
Second Prize	...	,, ,,	15·00
Third Prize	...	,, ,,	5·00

WEST GIRUWA PATTU.

For the best three plots of cotton grown in :—

West Giruwa Pattu.

First Prize	...	Gold Medal and Rs.	20·00
Second Prize	...	,, ,,	15·00
Third Prize	...	,, ,,	5·00

1. Each plot entered for the competition must not be less than $\frac{1}{2}$ of an acre in extent. Entries will close on February 28, 1925.

2. Competitors will give their names to the Mudaliyar of the Pattu or the Agricultural Officer, Ambalantota.

3. Judging will take place in March, 1925, and will be carried out by officers of the Agricultural Department, Southern Division.

4. The following is a list of points on which gardens will be judged :—

1.	Estimated yield ...	40
2.	Cleanliness (freedom from weeds)	20
3.	Freedom from Pests and Diseases	20
4.	Spacing	10
5.	Tilth of the soil ...	10
		100

F. BURNETT,
Divisional Agricultural Officer.

POULTRY.

THE FEEDING AND REARING OF CHICKENS.

T. B. CROSS.

Chicks hatched artificially should not be fed for at least 36 hours, which did not necessarily mean that the chicks should be confined in the drying box of the incubator for that period, provided the weather was fine and warm, they might be placed in some sheltered corner or brooder, the floor of which should be covered with fine sand, at which they may peck away to their hearts' content.

The question of food for chicks is a much debated one, and many methods of feeding are claimed to be excellent. In this connection one may say right away that the method of feeding is almost as important as the actual food itself. In other words, success in chick rearing cannot be done by a book, but only by continual care and experience gained by actual practice.

Until quite recently the first meal for chicks was not considered complete unless it contained finely-chopped hard-boiled egg. This we find in actual practice is not at all necessary. In fact, we may go so far as to say that it is even not desirable.

We are frequently informed that the egg must be good for chicks, as it is their natural food. Quite so, but not hard boiled.

Shortly before the chick leaves the shell a quantity of yolk matter is absorbed into the body, traces of which may be found for five days, or even longer, and this is Nature's provision for the chicks, and the reason why food is not really necessary for some considerable time after hatching.

Though one, or even two feeds of hard-boiled eggs may not do any harm, more should certainly not be given, as constipation is invariably the result. The preparation of finely-chopped hard-boiled egg for a large number of chicks cannot be done quickly.

If egg matter must be fed, let it be given in the form of a custard, dried off with coarse oatmeal. This is much safer, and certainly better for them.

Coarse oatmeal is one of the best foods for newly-hatched chicks for the first few meals, and one that is readily picked up. Being white in colour it quickly claims their attention, and soon the whole brood will be busily employed.

THE GOLDEN RULE.

"Little and often" is the golden rule in feeding chicks, and, if time permits, one cannot very well feed them too often, always provided only sufficient is given at one time to be readily cleared up. On no account should food be left about the floor of the brooder.

Until chicks are well grown (about 10 to 12 weeks old), I have no hesitation in saying that what is known as the "dry mash" method of

feeding is by far the best. Not only does this method save labour, but it practically eliminates bowel trouble, provided of course, that the meals, etc., used are of good quality.

By this I do not mean to infer that an occasional feed of wet or moist mash should not be given; in fact I am of opinion that a feed once daily of this will prove more beneficial than otherwise, as it provides a change, and if mixed with milk or soup will do a lot of good. But, here, again, it is very essential that every scrap of the mash should be cleared up, and none left about to become sour and tainted.

Generally speaking, however, the beginner is strongly advised to feed his chicks on dry mash only until experience is gained.

Dry mash should be fed in hoppers, so constructed that all waste is prevented. Chicks will, if they can, get into the hoppers and scratch the contents about, picking here and there, usually wasting a considerable portion of it.

As to whether the hoppers should be open all day or not is a debatable point, but as the last meal of the day should be of grain it is advisable, in order to get the chicks to fill their crops well, to remove the hoppers by 2 o'clock in the afternoon.

The following dry mash for chickens has been found satisfactory.

One to three weeks :—

1 part by measure coarse oatmeal
1 part by measure wheaten bran
1 part by measure pollard
1 part by measure mealie meal
¼ part by measure crayferine, fish or meat meal.

Three to six weeks :—

2 parts by measure wheaten bran
2 parts by measure Sussex ground oats
1 part by measure pollard
1 part by measure mealie meal
½ part by measure crayferine or meat meal

Six to twelve weeks :—

2 parts by measure wheaten bran
2 parts by measure pollard
1 part by measure Sussex ground oats
1 part by measure mealie meal
½ part by measure crayferine or meat meal

Usually a certain amount of fine meal or residue is found at the bottom of each hopper in the evening that the chicks cannot or will not eat. To utilise this, in order to prevent waste, it may be mixed with milk and fed to them the following day.

Dry-mash hoppers should be so constructed as to be rat and mouse proof, also damp proof. Many types of hoppers are on the market but quite serviceable utensils can be made from petrol tins and cases.

Needless to say, only the very best meals should be used, as inferior and musty meals will quickly cause bowel trouble in the flocks.

In addition to the above, two or three times weekly a little fine fresh green bone may be given. This is, without doubt, one of the best animal foods for chicks, but not easily obtainable away from towns.

Small grit should always be available, also granulated vegetable charcoal. The latter may be, if desired, mixed up with the dry mash feed in the hoppers.

GREEN FOOD.

To keep chicks in the best of health this is very necessary, and should be fed fresh and at least once daily, more often if possible.

Lucerne is excellent (nothing really better), but in most parts of Natal it is not always available. From the vegetable garden, however, quite a lot of stuff may be obtained that might otherwise be wasted, viz., carrot and onion tops, leeks, cabbage and lettuce leaves, etc. Willow leaves have been proved to be the most useful for this purpose.

The main thing, however, is to feed something fresh, green and succulent, and many common weeds, such as black jacks, pig weeds, etc., are considerably better than nothing at all.

Oats and other grains may be sprouted for chick feed quite successfully in mid-winter when little else is obtainable.

GRAIN.

In addition to the above a certain amount of grain feed is necessary. Two feeds of this daily will suffice, say, at 11 a.m. and again at 3 p.m., or later according to the time of the year. In other words the last feed of the day.

Good grain mixtures graded in three sizes are on the market, and generally give satisfaction, but can be made up as follows for chicks up to three weeks old :—

1 part by measure finely crushed maize (yellow)
1 part by measure finely crushed wheat
1 part by measure finely crushed kaffir corn
1 part by measure finely crushed millet

From 3 to 6 weeks :—

1 part by measure fine crushed maize (yellow)
1 part by measure fine crushed wheat
1 part by measure fine crushed kaffir corn
In two inches of fine scratching litter.

From 6 to 12 weeks :—

1 part by measure crushed maize
1 part by measure kaffir corn
1 part by measure wheat

Usually a large amount of grain feed is wasted, doves and other wild birds getting a big share. In many bought mixtures grains are included such as buck wheat, etc., which are seldom picked up.

The grain feed must also be looked upon as a means of making the young stock exercise, and should therefore, after the first three weeks, be scattered in litter, the depth of which should be increased as the birds grow. Exercise aids in developing sturdy chicks that make rapid growth, and is one of the most valuable preventives of disease.

WATER.

How soon water should be supplied to young chicks is another much debated point. In early spring, when the weather is cool, the morning of the third day is quite soon enough, but in mid-September, when days are hot, water can be safely given on the second day. Chicks with hens have been, to my knowledge, without water for five days, but were in a shady run.

When water has been once supplied, however, it should be constantly available, and given in a chick fountain containing a round pan. This will prevent overcrowding into the water.

Fountains with conical tops are better than those with flat tops, because the chicks cannot perch on them and foul the fountain and water with droppings. Clean water should be supplied at least once a day.

MILK.

Nothing is better for growing stock than milk, but unfortunately during the hatching and rearing season milk is generally scarce. Should only a limited quantity be available, it is advisable to mix it with the dry mash, and given one feed in the form of a moist or wet mash in the forenoon. Care must be taken that only just sufficient be given for the chicks to clear readily up. This feed of wet mash will vary the daily diet, and be eagerly devoured.

If plenty of milk is available, then the amount of animal food should be somewhat reduced. Milk should be fed in enamelled or earthenware vessels, as the lactic acid corrodes galvanised iron dishes or pans. The former should be of the fountain pattern, otherwise the chicks are likely to become plastered and sticky with milk, which tends to make them dirty.

RUNS.

Chicks should be put on the ground as soon as possible, and needless to say, the fresher and cleaner the run the better. On a large plant a piece of ground should be specially reserved for chickens and after being vacated at the end of the breeding season should be allowed to rest until the following year. These runs are better if under grass, even though the grass is dry, as it is likely to be in winter and early spring. If the chicks can run in a pen or enclosure in which some growing crop exists so much the better.

Nothing is better for young stock than insect life, and this can only be obtained in some plant growth.

A lucerne patch may be considered the ideal run, but unfortunately these are few and far between in this Province.

In runs where no grass grows, the ground should be from time to time hoed over, otherwise the soil is apt to become sour and tainted and sickness results. Dry air and sunlight are powerful vermicides and disease-preventing agencies.

Another point of importance in this connection is that when the surface of the run is hard the chickens cannot enjoy a dust bath, which always tends to keep them free of lice and consequently in good health. A change of run should be given as frequently as possible.

SHADE.

Live shade, that is shade provided by trees, creepers, plants, etc., is much better than that artificially made. Shade from the hot sun is very necessary indeed, in fact essential in this part of the world.

Where no shade is provided chicks will remain still for a considerable period of the day, and consequently will not exercise, growth being therefore retarded.

Mealies, sunflowers, etc., can be planted in runs to be used for chicks and runner beans, etc., trained on the wire netting fences. On the other hand too much shade can be a source of danger as the ground is apt to remain damp and shuts out light and air.

OVERCROWDING.

To rear chicks successfully overcrowding must be carefully guarded against, and only chicks of the same age and size should be kept together in brooders and runs.

The majority of poultry keepers hatch out more chickens than they have space for, and this is frequently the cause of heavy mortality in flocks. It is much better to have a smaller number of sound, healthy stock than a large number of birds not even fit for the pot!

CULLING.

This should commence right from the day the chicks are hatched and any deformed or crippled should be killed without delay. The process of culling must not stop here, but every day, if necessary, a sick or weakly chick should be destroyed. Remember that the health of the remainder depends to a great extent on this.

SEPARATING THE SEXES.

This should be done as soon as possible with the light breeds, *viz.*, Utility Leghorns, Anconas, etc., usually about four to five weeks of age. In other breeds, Wyandottes particularly, it is often very difficult to determine the sex until the birds are three to four months old. Apart from giving the pullets more room, the cockerels, especially of the Light Breeds, are apt to take the greater part of the food, keeping the pullets away from the hoppers and otherwise interfering with them.

Unless a poultry-keeper has established a reputation as a breeder of high-class stock it is very doubtful whether more than a few cockerels should be reared. Light breeds are not good table birds, in fact seldom worth the food to bring to maturity.

TOE-PICKING.

This habit or vice is not uncommon among newly-hatched chicks and may result from several causes. It does, however, undoubtedly happen on many occasions where chicks are put out for the first time by one accidentally picking the toes of another hard enough to draw blood.

One frequent cause is when toe-punching takes place and a little blood remains on the foot. Chicks have a natural taste for animal products and once they taste blood they will lose no opportunity in obtaining it.

Another cause is through injury to the foot or toes through scratching in the food hopper. Any chick injured in this manner or through careless toe-punching should be removed from the remainder without delay.

FINAL CONCLUSIONS.

Brooders, coops, feed and water utensils must be kept perfectly clean. Inspections should be made as often as possible in case insect pests, such as red mite, sand fleas, etc., are causing trouble.

Give the chicks a change of run every now and then; change of environment works wonders. Don't overcrowd in runs or broods; cull severely when necessary. Remember a layer without stamina and constitution is useless. Separate the cockerels and pullets as early as the sex can be determined.

Don't be afraid to introduce a little novelty and change into the feed menu of growing chicks.

Chicks cannot be reared altogether by the book—it cannot tell you, for instance, when your chicks are beginning to flag or when they require a change of run.

Exercise is absolutely essential both for the chick and the laying hen. This must be provided by means of scratching litter, and last, but not least, remember that chicks require just as much care and attention on Saturday, afternoon and Sunday as at any other time.—South African Poultry Magazine and Small-Holder, Vol. XVIII, No. 154.

GENERAL.

FORESTRY FOR WATER CONSERVATION.

C. S. JUDD,

Superintendent of Forestry.

In any discussion of the subject of food conservation it seems fitting to give some consideration to water conservation, for not only is water concomitant to food as a personal and domestic necessity, but in general, water also plays a very leading part in the irrigation of food crops, in moving food crops to the factory and the market and, to some extent, in supplying power for converting raw food materials to a state in which they are available for human consumption. Without water, therefore, human existence would be impossible and crop production very much handicapped.

The purpose of this paper is to set forth briefly some of the factors which tend to conserve this most necessary commodity and to describe more particularly the beneficial influence which forest growth exerts on a continuous supply of water here in the Territory of Hawaii.

In the first place, aside from the conservation of water, the beneficial influences which a forest growth exerts in the matter of windbreaks and in preventing erosion is well understood. Windbreaks, formed by planted trees, are found to be a necessity for the successful growing of cane crops close to the ocean shore on the windward side of these islands in order to intercept the salt content in the air and prevent it from burning the cane leaves. Further inland, planted windbreaks break the force of strong winds, retard rapid evaporation, and produce atmosphere and soil conditions more favourable to successful crop production. A satisfactory forest cover on the mountains, moreover, prevents erosion to some extent, and the washing of soil from agricultural fields by retarding a rapid runoff and holding floods back at their source.

The main purpose of the practice of forestry in the Territory of Hawaii is not for the production of timber or wood supplies, but for the conservation of water. The local government undertook real forestry work on an extensive and organized basis twenty years ago and it is specified in its statutes that the duty of the department intrusted with forestry work is to "devise ways and means of protecting, extending, increasing and utilizing the forests and forest reserves, more particularly for protecting and developing the springs, streams and sources of water-supply, so as to increase and make such water-supply available for use."

With the wide range of soil and altitude conditions found in various parts of these islands, it has been satisfactorily demonstrated that commercial timber can be grown here. On our best soil sites in protected regions the Australian red cedar of high timber value grows like a weed and the famous kauri pine of Queensland and the araucarias flourish and grow rapidly. Various species of eucalyptus thrive under a wide range of our

conditions and many successful plantations on gulch slopes and otherwise waste lands furnish fuel and minor wood supplies. Between the elevations of 6,500 and 8,000 feet on the slopes of Haleakala on Maui and on the slopes of Mauna Kea on Hawaii ten-year-old plantings of temperate zone coniferous trees have proved to be successful. Here, among other trees, the Coulter pine of Southern California, the incense cedar of the Pacific Coast, the white pine of New England and the deodar of India may be found growing as thriftily as in their native habitat.

But the necessary devotion of our valuable and limited lowlands to the raising of agricultural crops precludes their use for timber production to any extent and the cost of planting pine and cedar trees on the slopes of our high mountains is excessive and the expense of harvesting and manufacturing the crops of timber which could be produced there would far exceed, for some time to come, the price which we pay for Douglas fir and redwood lumber imported from the Pacific Coast States.

The extensive coastal forest of the mesquite or algaroba, which have been established and phenomenally extended through the medium of stock over an area of approximately 100,000 acres in less than 100 years on lands that originally were barren wastes, produce valuable supplies of wood for fuel, beans for fodder and blossoms for honey.

But pre-eminently the most valuable product of our main forest regions on the mountain slopes, which comprise about one fourth of the total land area of the Territory, is water, and because of our comparatively limited terrain, short and steep water-sheds, heavy rainfall in certain regions and high value of water for irrigating the distant fertile, sun-warmed lowlands, the value of this liquid product of the forest, on which the prosperity of our community largely depends, is appreciated.

Moreover, the demonstrable beneficial effect of a satisfactory forest cover in holding back the runoff and feeding it slowly to the springs and streams and to the underground artesian basins is so apparent under our peculiar and limited conditions that it is readily understood by the intelligent members of our population. For this reason, a public opinion generally favourable to the protection of this water-bearing forest has been created and the practice of forestry here has been correspondingly supported.

Forest protection for water rather than forest production for wood supplies, therefore, constitute the main duty of the forester here, and his job is to maintain the forests so that they will function to the highest degree in conserving water, to build them up by artificial planting where they have been depleted, and protect them from destructive agencies such as grazing stock, fire, and injurious human trespass.

The native Hawaiian forest is peculiarly constituted in that it is readily susceptible to damage and deterioration. It is a delicate inter-dependent association of shallow-rooted trees, shrubs, vines, ferns and other forms of ground cover, often maintaining an existence under hostile conditions as to soil and exposure, and in which the balance of nature is very easily upset.

In a healthy condition, this association of plants on our steep mountain slopes is admirably suited for holding back excessive rainfall. The foliage of the trees breaks the force of the rain and prevents the impacting of the soil by the rain drops. A considerable portion of the precipitation is let down to the ground slowly by this three-storied cover of trees, bushes, and floor plants. The soil is kept loose by the humus mulch formed of decayed leaves and fallen branches, and this factor combined with the network of penetrating roots affords better percolation and tends to convert excessive runoff to underground drainage. In this manner rainfall, dropping on a well forested area, is held back and instead of rushing down to the sea rapidly in the form of destructive freshets, is gradually fed to the springs and streams and even to the underground artesian basins where it is held for use over a much longer interval.

To function in this serviceable manner, however, the forests of this Territory must be maintained in the best possible condition, and to do this they must be given strict protection.

Fire, fortunately, is a minor factor in forest destruction throughout the forested regions of this Territory because of their generally moist condition. Only after a protracted drought of several weeks is a fire hazard created in most of our forest regions. A forest fire service composed of volunteer fire wardens works effectively in preventing and extinguishing forest and grass fires.

Far more damage has been done to the indigenous forest by stock grazing than by any other agency. This dates back many decades to the time when wild cattle roamed unconfined into the forest and has resulted in pushing back its natural boundaries.

The reason for forest destruction in this manner is not easily understood by the layman or by those who are familiar with permitted grazing allotments in the open pine forests of the National Forests in the western states of the mainland. Our forests here are constituted quite differently. The shallow-rooted trees depend for proper moisture and soil conditions on the undergrowth of bushes and ferns, and when the latter plants, the first to be attacked by stock, are removed, the tree roots dry out, the trees are weakened and begin to decline, and an opening is made for the invasion of destructive insects and fungi and of more vigorously growing foreign grasses and other plants which choke out native growth and prevent tree reproduction. It is always dangerous for this reason to make any opening in our native forest and the only safe way to keep it healthy and vigorous is to maintain it inviolable by keeping the ground well shaded and dark.

Fencing out stock, therefore, on exposed boundaries and shooting the trespassing outlaw cattle and other damaging stock are some of the main duties of the forest ranger in Hawaii, and the post-hole-digger and rifle rather than the saw and axe constitute his working tools.

In certain regions forest deterioration has resulted from adverse soil conditions, a much more difficult problem to solve, and here the strengthening of the forest by the introduction of vigorously growing trees and plants is being attempted by the planting of various species of ficus and other exotic trees. The suggestion of any trees or plants which promise to aid in this work will be greatly appreciated.

Forest lands devoted to the purpose of water conservation are officially recognized as forest reserves by proclamation of the Governor of Hawaii. The demarcation of such lands began in 1904, and to date 50 of such reserves have been set aside on the five main islands of the group. These embrace a total area of 840,984 acres, of which 68 per cent. is land belonging to the Territory. The owners of the private lands within the proclaimed boundaries of these reserves usually recognize their value for strictly forest purpose and as a rule co-operate heartily in their protection from damage.

For the management of these reserves, funds for an inadequate force of only eight forest rangers, in addition to a score of tree planters, are now available, but it is confidently hoped that the finances of the Territory will soon permit of a generous extension of this service.

Where the native forest has been destroyed and is in need of rebuilding, artificial planting is resorted to and in fact was begun by the Government before the present forest service was organized. The native koa tree, which is easily handled in the nursery, is used on situations of good soil drainage. Kukui and other indigenous species are used to a minor extent depending on the available sites. A wide variety of introduced trees is being planted in the effort to determine on the proper trees to be used more extensively in reforestation work. In this respect the Hawaiian Sugar Planters' Association has been particularly active of late years by the raising and distributing from its several nurseries hundreds of thousands of trees and by extensive tree planting on private lands under its control within the forest reserve.

To raise trees for its own use and for general distribution for the encouragement of increased planting throughout the Territory the Government maintains four main nurseries on the largest islands. The output from these nurseries includes forest, shade and ornamental trees and also shrubs and vines in demand by the home builder.

Returns from tree planters throughout these islands show that 455,780 trees were planted during 1922 and 578,266 during the calendar year 1923.

A side issue in tree planting, but nevertheless considered important, has been the establishment by the Territory of a plantation of 3,000 chaulmoogra oil trees at Waiahole, Oahu.

The particular work in which the Division of Forestry is now engaged and on which the field work is about completed is the extension of the forest reserve system on the island of Oahu to embrace privately-owned forest lands. This will add many thousands of acres to the present system. As a result of the effort to place canned pine-apples in a high second position, next to sugar as the chief article of export from this Territory the cultivation of the pine-apple is being extended particularly on the island of Oahu so that in places it is encroaching on areas where a forest cover is of greater importance. In the work of running these new forest reserve lines it has been the aim to strike a just and fair balance and judiciously to select a boundary below which pine-apple cultivation may and should be practised, but above which the forest should be given absolute protection.

The rapidly increasing population on the island of Oahu will eventually be limited by the amount of water available for its domestic use. In times of drought the pinch has already been felt. The effort is therefore now being made to demarcate once for all the boundaries of permanent reserves above which the forest cover should be built up and given absolute protection so that it may function to the highest degree as a conserver of water.—The Hawaiian Forester and Agriculturist, Vol. XXI, No. 3.

RICE IN CALIFORNIA.

The following extract is taken from the *Farmers' Bulletin* No. 1240, of the U. S. Department of Agriculture, on "How to Grow Rice in the Sacramento Valley" by Jenkin W. Jones, Agronomist, Office of Cereal Investigations, Bureau of Plant Industry.

Investigations begun by the United States Department of Agriculture in the spring of 1909 and continued for three years provided information which indicated the commercial possibilities of rice culture in California. The first commercial rice crop was grown in California in 1912 on Stockton clay—adobe soil in the Sacramento Valley, near Biggs. The high acre yields and large profits from this crop of 1,400 acres received wide publicity, which stimulated interest and resulted in the rapid expansion of the California rice industry. In 1914, 15,000 acres were sown, while in 1915 the crop was grown on 34,000 acres. The high price of rice during the World War naturally caused a further increase in acreage and production. The maximum so far was reached in 1920, when 9,720,000 bushels of rice were produced on 162,000 acres. The acreage in 1921 and 1922 was less than in 1920, the estimate for 1922 being 140,000 acres with a production of 8,260,000 bushels.

Rice is grown in California only in the San Joaquin and Sacramento Valleys. Most of the crop is produced in the Sacramento Valley in Butte, Glenn, Colusa, Sutter, and Yolo Counties.

The area on which rice can be profitably grown in the United States is much more limited than that on which most of the other cereal crops can be produced with profit. Rice is, however, well adapted to certain sections.

During the 5-year period from 1917 to 1921 the average annual area sown to rice in the United States was 1,083,000 acres and the average annual production 41,107,000 bushels. In the same period the average annual acreage sown to rice in California was 125,244 acres and the average annual production 7,481,000 bushels. During this period California has produced more than one-sixth of the total annual rice crop of the United States on less than one-eighth of the total annual acreage.

The average yield per acre in California is considerably higher than that obtained in other large rice-producing States. The 10-year average yield from 1910 to 1919 for California was 53·9 bushels; for Arkansas, 40·9 bushels; for Texas, 33·8 bushels; for Louisiana, 33·6 bushels; and for the United States, 35·7 bushels per acre.

In California barley is the leading cereal in total production and total value. Wheat ranks second and rice third. The average annual acreage sown to barley from 1919 to 1921, inclusive, was 1,141, 000 acres; wheat, 786,000 acres; and rice, 146,000 acres. During this 3-year period the average annual production of barley was 28,525,000 bushels, valued at $27,652,000; wheat, 11,529,000 bushels, valued at $20,434,000; and rice 8,468,000 bushels, valued at $13,486,000. For this period the average acre yield of barley was 1,200 pounds, valued at $24·75; of wheat, 880 pounds, valued at $22·66; and of rice, 2,610 pounds, valued at $95.31. The average acre value of rice during this 3-year period has been 3·8 times that of barley, 4·2 times that of wheat, 2·3 times that of corn, 4·4 times that of oats, and 3·2 times that of grain sorghum

By contrast, rice sown on one-eighth of the average barley acreage has produced nearly half as much agricultural wealth. Sown on less than one-fifth of the average wheat acreage rice has produced nearly two-thirds as much agricultural wealth. Rice is grown chiefly on land which was used for wheat and barley culture prior to the introduction of rice, so under rice culture this land is much more productive than it was when wheat and barley were grown.

A NEW USE FOR RUBBER.

THE PRESERVATION OF FRUITS.

We extract from the *Bulletin de la Societe Nationale d'Acclimatation* for March 1924 the following passage which shows that it is possible to become acquainted in France with certain delicious fruits of the Far East which are too delicate to endure long voyages without preparation.

"Monsieur A. Chevalier shows mangosteens preserved according to the method of Dr. Cramer of Java. These fruits are opened at the meeting; they are in a perfect state of preservation and are declared excellent and very refreshing. Our colleague gives us some interesting details regarding the process of preservation. Dr. P. J. S. Cramer, Director of the Plant Breeding Station at Buitenzorg, sought a practical method for facilitating the export to Europe of certain tropical fruits other than bananas and pine-apples, so much esteemed as dessert fruits in the colonies, but which do not usually reach France in a state of sufficient preservation for being put on the market.

"His method consists in coating the fruits, which are gathered a little before they are ripe, with a thin layer of rubber latex, which on coagulating forms a protective cover around the fruit. The changes attending the ripening of the fruit are thus retarded. The fruit is also, at least to a great extent, protected against organisms which bring about the decay of vegetable matter.

"In order to test his method, Dr. Cramer has just sent to the Laboratoire d'Agronomie coloniale a very interesting consignment of mangosteens (*Garcinia Mangostana, L.*)

"This consignment arrived on the lst of December last after a voyage of about a month, brought over by a collaborator of Dr. Cramer in a small case which he kept in his cabin. The mangosteens were covered with a thin film of rubber and each fruit was wrapped up in a piece of greased paper. 60 per cent. of the fruits were in perfect condition; the pericarp had assumed the violaceous tint that is usual in the ripe fruits, and had become slightly soft under the pressure of the fingers. On opening it for extracting the pulp, it is noticed that this pulp has the same freshness and the same flavour as that of fruits recently gathered.

"Dr. Cramer's process of preservation is of great interest and it can be of practical application not only for the importation of seeds of fruit trees intended for experiments in cultivation and acclimatisation, but also for placing on the market new fruits from our colonies."

MARKET RATES.

MARKET RATES FOR SOME CEYLON PRODUCTS.

(FROM THE CEYLON CHAMBER OF COMMERCE WEEKLY PRICE CURRENT, DATED 15th DECEMBER, 1924.)

NAME OF PRODUCE		CURRENT PRICE			REMARKS
		Rs. cts.	at	Rs. cts.	
CACAO—(At Buyer's Stores)					
Estate—Finest	per cwt.	55 00	,,	63 00	
Do Medium	do	35 00	,,	50 00	
Do Common (Black)	do	10 00	,,	25 00	
CARDAMOMS					
All round parcel well bleached	per lb.	... ...	,,	... ...	
Do do medium	do	3 15	,,	3 35	
Special assortment 0 & 1 only	do	... ...	,,	... ...	
Seeds	do	3 75	,,	3 85	
Green	do	3 50	,,	3 70	
CINNAMON QUILLS—(At Buyer's Stores)					
Ordinary assortment (in bales of 100 lb. nett)	per lb.	0 88	,,	0 95	
No. 1	do	0 90	,,	0 97	
No. 2	do	0 88	,,	0 95	
No. 3	do	0 85	,,	0 91	
No. 4	do	0 80	,,	0 86	
CINNAMON CHIPS—Maradana, (At Buyer's Stores) (in bags of 56 lb. nett) per candy of 560 lb.		80 00	,,	90 00	
CITRONELLA OIL—(ex-Seller's Stores without packages)	per lb.	1 90	,,	2 00	
COCONUT—(Desiccated) Granulated goods (Delivered at Wharf or Buyer's Stores) Assortment: Medium 50 per cent. Fine 50 per cent.	per lb.	0 19¼	,,	0 20	
COCONUT OIL—					
White Oil f.o.b	per ton	... ...	,,	610 00	
Ordinary Oil do	do	575 00	,,	580 00	
COPRA—					
Calpentyn	No. 1 quality per candy of 560 lb.	76 00	,,	85 50	
Estate	,, ,,				
Ordinary quality (Maravila)	,, ,,				
Cart Do do	,, ,,				
FIBRES—(At Buyer's Stores)					
Coconut Bristle No. 1	per cwt.	7 50	,,	10 20	
Do No. 2	do				
Coconut Mattress No. 1	do	2 60	,,	3 00	
Do No. 2	do				
Coir yarn, Kogalla Nos. 4 to 9	do	12 50	,,	25 00	
Do Colombo Nos. 3 to 7	do				

PLUMBAGO		X. B.			B.			B. E.		
		Rs. cts.		Rs. cts.	Rs. cts.		Rs. cts.	Rs. cts.		Rs. cts.
Ordinary Lumps ...	per ton	260 00	at	325 00	...	at	275 00	...	at	200 00
Chips ...	do	185 00	,,	275 00	...	,,	200 00	140 00	,,	160 00
Dust ...	do	140 00	,,	200 00	...	,,	125 00	75 00	,,	90 00
Do Flying ...	do	...	,,	145 00	...	,,	95 00	...	,,	60 00

ANIMAL DISEASE RETURN FOR THE MONTH ENDED 31st DECEMBER, 1924.

Province, &c.	Disease	No. of Cases up to date since Jan. 1st, 1924	Fresh Cases	Recoveries	Deaths	Balance Ill	No. Shot
Western	Rinderpest	1235	20	467	736	9	23
	Foot-and-mouth disease	1965	21	1946	19	—	—
	Anthrax	7	—	—	7	—	—
	Hæmorrhagic Septicæmia	6	—	2	4	—	—
	Rabies	1	—	—	—	—	1
Colombo Municipality	Rinderpest	1235	—				
	Foot-and mouth disease	164	10	*			
	Anthrax	—	—				
	Rabies	6	4	*			
Cattle Quarantine Station	Rinderpest	10	—				
	Foot-and-mouth disease	35	8	*			
	Anthrax	227†	40	*			
	Pleuro-Pneumonia (in goats)	115	—				
Central	Rabies (Dogs)	13	—	—	13	—	—
	Foot-and-mouth disease	1219‡	254	1020	17	182	—
	Anthrax	9	1	—	9	—	—
	Hæmorrhagic Septicæmia	1	—	—	1	—	—
	Piroplasmosis	4	—	4	—	—	—
	Mange (in Buffaloes)	6	—	6	—	—	—
Southern	Rinderpest	193	1	56	137	—	—
	Foot-and-mouth disease	2	—	2	—	—	—
	Anthrax	—	—	—	—	—	—
Northern	Rinderpest	—	—	—	—	—	—
	Foot-and-mouth disease	—	—	—	—	—	—
	Anthrax	—	—	—	—	—	—
	Hæmorrhagic Septicæmia	98§	—	3	95	—	—
Eastern	Rinderpest	—	—	—	—	—	—
	Foot-and-mouth disease	62	33	62	—	—	—
	Anthrax	—	—	—	—	—	—
North-Western	Rinderpest	348	10	126	200	2	20
	Foot-and-mouth disease	1401	82	1362	9	29	1
	Anthrax	12‖	—	—	12	—	—
	Rabies (Dogs)	2	—	—	—	—	2
North-Central	Rinderpest	—	—	—	—	—	—
	Foot-and-mouth disease	340	135	340	—	—	—
	Anthrax	—	—	—	—	—	—
Uva	Rinderpest	—	—	—	—	—	—
	Foot-and-mouth disease	56	45	11	—	45	—
	Anthrax	3	—	—	3	—	—
	Black Quarter	26	—	—	26	—	—
Sabaragamuwa	Rinderpest	35	—	4	25	—	6
	Foot-and-mouth disease	2353	10	2348	5	—	—
	Anthrax	12	—	—	12	—	—
	Hæmorrhagic Septicæmia	17	—	—	17	—	—
	Rabies (Dogs)	2	—	—	1	—	1

* In November & December.
† 2 cases amongst cattle, the rest amongst goats.
‡ 39 cases mouth disease in goats.
§ 23 cases amongst goats. ‖ 1 dog

M. CRAWFORD,
Acting Government Veterinary Surgeon.

Colombo, 20th January, 1925.

METEOROLOGICAL

DECEMBER, 1924.

Station	Temperature: Mean Daily Shade	Temperature: Difference from Average	Mean Humidity	Mean amount of Cloud 0=clear 10=overcast	Mean Wind Direction during Month	Daily Mean Velocity	Rainfall: Amount	Rainfall: No. of Rainy Days	Rainfall: Difference from Average
	°	°	%			Miles	Inches		Inches
Colombo Observatory	79·6	+0·6	78	3·8	N	131	10·83	11	+ 5·99
Puttalam	77·9	+0·3					5·58	15	— 0·71
Mannar	79·6	+0·8	78	6·4	NNE	271	3·84	13	— 4·12
Jaffna	78·4	+0·8	77	6·2	NE	84	5·72	16	— 4·96
Trincomalee	78·7	+0·1	80	7·5	NNE	216	10·09	24	— 4·36
Batticaloa	78·0	0	84	5·4	Var:	209	9·31	19	— 7·47
Hambantota	78·7	+0·2	80	4·4	NE	315	3·91	12	— 1·53
Galle	78·6	+0·2	82	4·4	Calm	56	5·65	11	— 1·03
Ratnapura	80·6	+1·2	76	5·6	—	—	16·84	19	+ 8·07
Anu'pura	76·6	—0·4	82	5·9	—	—	4·30	15	— 4·67
Kurunegala	77·8	—0·2	78	5·1	—	—	3·68	14	— 3·97
Kandy	74·9	+0·4	78	6·3	—	—	5·02	17	— 4·10
Badulla	70·8	+0·2	85	7·0	—	—	9·48	24	— 2·95
Diyatalawa	64·8	—0·2	82	7·6	—	—	5·19	21	— 2·92
Hakgala	58·2	+0·2	92	8·6	—	—	11·63	25	— 0·84
N.' Eliya	58·2	+0·4	81	5·8	—	—	5·36	20	— 3·21

The conditions during this month can be summarised roughly by saying that December is a month in which cyclonic depressions are sufficiently frequent to have a distinct effect on the rainfall averages, but that in the case of December 1924 freedom from any serious cyclonic movement over the island resulted in most stations having deficient rainfall even in cases where the number of days on which rain fell was up to its normal amount.

Local thunderstorms were responsible for several falls of over 3 inches in a day, but no falls of over 5 inches were reported. In particular rain was deficient during the last week of the month to the distinct gratification of many holiday makers.

Those stations at which the average rainfall was reached were chiefly in Sabaragamuwa and the Western Province.

The total wind movement was slightly above average at most stations, though in the case of Galle the word calm appears so often in the reports as to justify its use in the table above in the column for "mean wind direction."

Temperatures were slightly above average except in the case of three island stations, and Humidity was below average in nearly every case.

A. J. BAMFORD,
Supdt. Observatory